VAISALA

USER'S GUIDE

Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330

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Table of Contents

CHAPTER 1

GENERAL INFORMATION 11

About This Manual 11

Contents of This Manual 11

Version Information 12

General Safety Considerations 12

Feedback 13

Product Related Safety Precautions 13

ESD Protection 13

Regulatory Compliances 14

Transmitters with LAN or WLAN Interface 14

Transmitters with WLAN Interface 14

Recycling 15

Trademarks 15

License Agreement 15

Warranty 16

CHAPTER 2

PRODUCT OVERVIEW 17

Introduction to HMT330 17

Basic Features and Options 18

Structure of the Transmitter 19

Probe Options 21

Warmed Probe HMT337 22

CHAPTER 3

INSTALLATION 23

Mounting the Housing 23

Standard Mounting without Mounting Plate 23

Wall Mounting with Wall Mounting Kit 24

Mounting with DIN Rail Installation Kit 25

Pole Installation with Installation Kit for Pole or Pipeline 26

Mounting Rain Shield with Installation Kit 28

Panel Mounting Frame 28

Wiring 30

Cable Bushings 30

Grounding the Cables 31

Grounding the Transmitter Housing 32

Signal and Power Supply Wiring 33

Connections to a 24 VAC Power Supply 34

Probe Mounting 36

General Instructions for Probes with a Cable 37

HMT333 for Ducts and Tight Spaces 39

HMT334 for High Pressure and Vacuum Applications 39

HMT335 for High Temperatures....41
HMT337 for High Humidity Applications....42
Temperature Probe (Optional) 42
HMT338 for Pressurized Pipelines....42
Tightening the Clasp Nut....44
Optional Modules 45
Power Supply Module 45
Installation 46
Warnings 47
Galvanic Isolation for Output....50
Third Analog Output 50
Installation and Wiring....51
Relays....52
Installation and Wiring....52
Selecting the Activation State of the Relay 52
RS-422/485 Interface 54
Installation and Wiring....54
LAN Interface....56
WLAN Interface 57
Attaching the WLAN Antenna 58
Data Logger Module....58
8-Pin Connector....61

CHAPTER 4
OPERATION....63
Getting Started....63
Display/Keypad (Optional)....63
Basic Display....63
Graphic History....64
Menus and Navigation....66
Changing the Language....67
Rounding Setting....68
Display Backlight Setting....68
Display Contrast Setting....68
Keypad Lock (Key guard)....68
Menu PIN Lock....69
Factory Settings 69
Display Alarms....70
Configuring a Display Alarm....70
MI70 Link Program for Data Handling 72
Serial Line Communication 72
User Port Connection 73
Service Port Connection....74
Connection Cables....74
Installing the Driver for the USB Cable 75
Using the Service Port....75
LAN Communication 76
IP Configuration....76
Using Display/Keypad 77
Using Serial Line 78
Wireless LAN Configuration 80
Using Display/Keypad 80
Using Serial Line 82

Telnet Settings 83
Web Configuration for LAN and WLAN..... 83
Terminal Program Settings 84
List of Serial Commands 87
Getting Measurement Message from Serial Line..... 89
Starting Continuous Outputting..... 89
R..... 89
Stopping Continuous Outputting..... 90
S..... 90
Outputting Reading Once 90
SEND 90
SEND D 90
Formatting Serial Line Message 91
FTIME and FDATE..... 91
FST 91
General Settings..... 92
Changing Quantities and Units 92
Using Display/Keypad..... 92
Using Serial Line..... 93
FORM..... 93
UNIT..... 95
Pressure Compensation Setting 95
Using Display/Keypad..... 95
Using Serial Line..... 96
PRES and XPRES..... 96
Date and Time..... 97
Using Display/Keypad..... 97
Using Serial Line..... 97
User Port Serial Settings..... 98
Using Display/Keypad..... 98
Using Serial Line..... 99
SERI..... 99
SMODE..... 99
INTV..... 100
ECHO..... 100
Data Filtering..... 101
FILT..... 101
Device Information 101
? 102
HELP..... 103
ERRS 103
VERS 104
Resetting Transmitter Using Serial Line 104
RESET 104
Locking Menu/Keypad by Using Serial Line 104
LOCK 104
Data Recording..... 105
Selecting Data Recording Quantities..... 105
DSEL..... 105
View Recorded Data 106
DIR 106
PLAY 107
Deleting the Recorded Files..... 109
UNDELETE..... 109

Analog Output Settings 109
Changing Output Mode and Range 109
Analog Output Quantities 111
AMODE/ASEL 112
Analog Output Tests 113
ITEST 113
Analog Output Fault Indication Setting 114
AERR 114
Operation of Relays 115
Quantity for Relay Output 115
Measurement-Based Relay Output Modes 115
Relay Setpoints 115
Hysteresis 116
Relay Indicating Transmitter Error Status 116
Enabling/Disabling Relays 118
Setting Relay Outputs 118
RSEL 119
Testing Operation of Relays 120
RTEST 121
Operation of the RS-485 Module 121
Networking Commands 122
SDELAY 122
SERI 122
ECHO 123
SMODE 123
INTV 124
ADDR 124
SEND 125
OPEN 125
CLOSE 125
Sensor Functions 126
Chemical Purge (Optional) 126
Automatic Chemical Purge (Interval Purge) 127
Manual Chemical Purge 127
Chemical Purge in Power Up 127
Starting and Configuring Chemical Purge 128
Using Buttons on Motherboard 128
Using Display/Keypad (Optional) 128
Using Serial Line 129
PURGE 129
PUR 130
Sensor Heating 131
Setting Humidity Sensor Heating 131
XHEAT 131

CHAPTER 5
MAINTENANCE 133
Periodic Maintenance 133
Cleaning 133
Changing the Probe Filter 133
Changing the Sensor 134
Error States 135
Technical Support 137

Return Instructions **137**
Vaisala Service Centers **138**

CHAPTER 6

CALIBRATION AND ADJUSTMENT **139**
Opening and Closing the Adjustment Mode **139**
Relative Humidity Adjustment **141**
Using Push-Buttons 141
Using Display/Keypad 142
Using Serial Line 143
CRH 143
Relative Humidity Adjustment after Sensor Change **144**
Using Display/Keypad 144
Using Serial Line 144
FCRH 145
Temperature Adjustment **145**
Using Display/Keypad 145
Using Serial Line 146
Analog Output Adjustment **147**
Using Display/Keypad 147
Using Serial Line 147
ACAL 147
Feeding Adjustment Information **148**
Using Display/Keypad 148
Using Serial Line 148
CTEXT 148
CDATE 148

CHAPTER 7

TECHNICAL DATA **149**
Specifications **149**
Performance 149
Relative Humidity 149
Temperature (+ Operating Pressure Ranges) 150
Optional Temperature Probe 151
Calculated Variables 151
Accuracies of Calculated Variables 151
Accuracy of Dewpoint Temperature °C 151
Accuracy of Mixing Ratio g/kg (Ambient Pressure 1013 mbar) 152
Accuracy of Wet Bulb Temperature °C 152
Accuracy of Absolute Humidity g/m³ 152
Dewpoint Temperature (HMT337 Warmed Probe Option) 153
Operating Environment 153
Inputs and Outputs 154
Mechanics 154
Transmitter Weight 155
Technical Specifications of Optional Modules 155
Power Supply Module 155
Analog Output Module 155
Relay Module 156
RS-485 Module 156

LAN Interface Module....156
WLAN Interface Module....156
Data Logger Module....157
Options and Accessories....158
Dimensions (mm/inch)....160
HMT331....161
HMT333....162
HMT334....162
HMT335....163
HMT337....163
HMT338....164
Temperature Probe....164

APPENDIX A
PROBE INSTALLATION KITS AND INSTALLATION EXAMPLES....165
Duct Installation Kits (for HMT333/337/335)....165
Duct Installation Kit for Temperature Probe (for HMT337)166
Pressure Tight Swagelok Installation Kits (for HMT337)..167
RH Probe Installation....167
Temperature Probe Installation....167
Examples of Vapor Tight Installations with Cable Gland..168
RH-Probe Installations (for HMT333/337)....168
T- Probe Installations (HMT337)....169
Example of Climate Chamber Installation....170
Example of Installation Through Roof....171
Ball Valve Installation Kit for HMT338....172
Meteorological Installation Kit (for HMT337)....174

APPENDIX B
CALCULATION FORMULAS....175

List of Figures

Figure 1 Transmitter Body 19
Figure 2 Inside the Transmitter 20
Figure 3 Probe Options 21
Figure 4 Standard Mounting 23
Figure 5 Mounting with Wall Mounting Kit 24
Figure 6 Dimensions of the Plastic Mounting Plate (mm/inch) 24
Figure 7 Mounting with the DIN Rail Installation Kit 25
Figure 8 Vertical Pole 26
Figure 9 Horizontal Pole 26
Figure 10 Mounting with Metal Wall Mounting Plate 27
Figure 11 Dimensions of the Metal Mounting Plate (mm/inch) 27
Figure 12 Mounting the Rain Shield with the Installation Kit 28
Figure 13 Panel Mounting Frame 29
Figure 14 Panel Mounting Dimensions (mm/inch) 29
Figure 15 Cable Bushings 30
Figure 16 Grounding the Screen of Electrical Cable 31
Figure 17 Screw Terminal Block on Motherboard 33
Figure 18 Connections to 24 VAC Power Supply 35
Figure 19 Measurement Error at 100 %RH 36
Figure 20 Horizontal Mounting of Probe 37
Figure 21 Vertical Mounting of Probe 38
Figure 22 HMT344 Probe 40
Figure 23 Tightening the Nut 40
Figure 24 Cleaning of Tightening Cone 41
Figure 25 HMT338 Probe 43
Figure 26 Sealing of Fitting Body into Process 43
Figure 27 Tightening the Clasp Nut 44
Figure 28 Power Supply Module 45
Figure 29 Galvanic Output Isolation Module 50
Figure 30 Third Analog Output 50
Figure 31 Third analog output selection 51
Figure 32 Relay Module 53
Figure 33 RS-485 Module 54
Figure 34 4-Wire RS-485 Bus 55
Figure 35 LAN Interface Module 57
Figure 36 WLAN Interface Module 58
Figure 37 Data Logger Module 60
Figure 38 Wiring of Optional 8-Pin Connector 61
Figure 39 Basic Display 64
Figure 40 Graphical Display 64
Figure 41 Graphical Display with Data Logger 65
Figure 42 Main Menus 67
Figure 43 Display Alarm Active 70
Figure 44 Display Alarms 71
Figure 45 Modifying an Alarm Limit 71
Figure 46 Service Port Connector and User Port Terminal on Mother Board 73
Figure 47 Connection Example Between PC Serial Port and User Port 74
Figure 48 Network Interface Menu 78
Figure 49 IP Configuration Menu 78
Figure 50 Wireless LAN Settings 81

Figure 51 Entering Network SSID....81
Figure 52 Selecting the Wireless Network Type....81
Figure 53 Web Configuration Interface for WLAN....84
Figure 54 Connecting Using Serial Interface....85
Figure 55 Connecting Using a Network....85
Figure 56 Hyper Terminal Serial Port Settings....86
Figure 57 Device Information on Display....102
Figure 58 Current/Voltage Switches of Output Modules....110
Figure 59 Measurement-Based Relay Output Modes....115
Figure 60 FAULT/ONLINE STATUS Relay Output Modes....117
Figure 61 Relay Indicators on Display....118
Figure 62 Decrease of Sensor Gain....126
Figure 63 Purge Buttons on Motherboard....128
Figure 64 Chemical Purge Settings....128
Figure 65 Performing Chemical Purge....129
Figure 66 Changing the Sensor....134
Figure 67 Error Indicator and Error Message....135
Figure 68 Adjustment and Purge Buttons....140
Figure 69 Adjustment Menu....140
Figure 70 Selecting Point 1 Reference Type....142
Figure 71 Accuracy over Temperature Range....150
Figure 72 Accuracy in Dewpoint Measurement....153
Figure 73 Transmitter Body Dimensions....160
Figure 74 WLAN Antenna Dimensions....161
Figure 75 HMT331 Probe Dimensions....161
Figure 76 HMT333 Probe Dimensions....162
Figure 77 HMT334 Probe Dimensions....162
Figure 78 HMT335 Probe Dimensions....163
Figure 79 HMT337 Probe Dimensions....163
Figure 80 HMT338 Probe Dimensions....164
Figure 81 Optional Temperature Probe Dimensions....164
Figure 82 Duct Mounting Installation Kit....165
Figure 83 Duct Mounting Installation Kit for T-Probe....166
Figure 84 Swagelok Installation Kit for RH-probe....167
Figure 85 Swagelok Installation Kit for T-Probe....167
Figure 86 Cable Installation with Cable Gland....168
Figure 87 Probe Installation with Cable Gland....168
Figure 88 Vapor Tight Installation....169
Figure 89 Wall Mounting Installation....169
Figure 90 Climate Chamber Installation (not Available from Vaisala)....170
Figure 91 Example of Installation through Roof....171
Figure 92 Installing the HMT338 Probe Through a Ball Valve Assembly....172
Figure 93 Meteorological Installation Kit for Outdoor Installation....174

List of Tables

Table 1	Manual Revisions	12
Table 2	Quantities Measured by HMT330	17
Table 3	Optional Quantities Measured by HMT330	18
Table 4	HMT338 Probe Dimensions	43
Table 5	Connecting the Twisted Pair Wires to the Screw Terminals	54
Table 6	4-Wire (Switch 3: On)	55
Table 7	2-Wire (Switch 3: Off)	56
Table 8	Observartion Periods and Resolution	59
Table 9	Wiring of 8-Pin Connector	61
Table 10	Periods for Trend and Max/Min Calculations	65
Table 11	Graph Information Messages in Cursor Mode	66
Table 12	Default Serial Communication Settings for the User Port	73
Table 13	Communication Settings for the Service Port	76
Table 14	IP Settings for the LAN and WLAN Interfaces	77
Table 15	Wireless LAN Settings	80
Table 16	Measurement Commands	87
Table 17	Formatting Commands	87
Table 18	Data Recording Commands	87
Table 19	Chemical Purge Commands	88
Table 20	Calibration and Adjustment Commands	88
Table 21	Setting and Testing the Analog Outputs	88
Table 22	Setting and Testing the Relays	88
Table 23	Other Commands	89
Table 24	FORM Command Modifiers	94
Table 25	Multiplication Factors	96
Table 26	Selection of Output Modes	100
Table 27	Filtering Levels	101
Table 28	Error Messages	136
Table 29	Indicator Led Functions	140
Table 30	Calculated Variables (Typical Ranges)	151
Table 31	Transmitter Weight (in kg/lb)	155

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CHAPTER 1

GENERAL INFORMATION

This chapter provides general notes for the manual and the product.

About This Manual

This manual provides information for installing, operating, and maintaining Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330.

Contents of This Manual

This manual consists of the following chapters:

- Chapter 1, General Information, provides general notes for the manual and the product.
- Chapter 2, Product Overview, introduces the features, advantages, and the product nomenclature of HMT330.
- Chapter 3, Installation, provides you with information that is intended to help you install the product.
- Chapter 4, Operation, contains information that is needed to operate this product.
- Chapter 5, Maintenance, contains information that is needed in basic maintenance of the product.
- Chapter 6, Calibration and Adjustment, provides information and instructions concerning calibration and adjustment of HMT330.
- Chapter 7, Technical Data, provides the technical data of the product.

- Appendix A, Probe Installation Kits and Installation Examples, presents the installation kits available for HMT330 and provides some installation examples.
- Appendix B, Calculation Formulas, presents the equations used in HMT330 to calculate values of dewpoint, mixing ratio, absolute humidity and enthalpy in normal pressure.

Version Information

Table 1 Manual Revisions

Manual Code	Description
M210566EN-A	September 2004 - First release.
M210566EN-B	November 2004
M210566EN-C	September 2005
M210566EN-D	November 2006
M210566EN-E	June 2007 - New options added: Data logger module, USB-RJ45 cable, new sensors HUMICAP® 180R and HUMICAP® 180RC. Support for Chinese language.
M210566EN-F	May 2008 – New options added: LAN Interface, WLAN Interface. Display Alarm feature added.

General Safety Considerations

Throughout the manual, important safety considerations are highlighted as follows:

WARNING Warning alerts you to a serious hazard. If you do not read and follow instructions very carefully at this point, there is a risk of injury or even death.

CAUTION Caution warns you of a potential hazard. If you do not read and follow instructions carefully at this point, the product could be damaged or important data could be lost.

NOTE Note highlights important information on using the product.

Feedback

Vaisala Customer Documentation Team welcomes your comments and suggestions on the quality and usefulness of this publication. If you find errors or have other suggestions for improvement, please indicate the chapter, section, and page number. You can send comments to us by e-mail: manuals@vaisala.com

Product Related Safety Precautions

The Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330 delivered to you has been tested for safety and approved as shipped from the factory. Note the following precautions:

WARNING	Ground the product, and verify outdoor installation grounding periodically to minimize shock hazard.

CAUTION	Do not modify the unit. Improper modification can damage the product, lead to malfunction, or make the product noncompliant with applicable legislation.

ESD Protection

Electrostatic Discharge (ESD) can cause immediate or latent damage to electronic circuits. Vaisala products are adequately protected against ESD for their intended use. However, it is possible to damage the product by delivering electrostatic discharges when touching, removing, or inserting any objects inside the equipment housing.

To make sure you are not delivering high static voltages yourself:

- Handle ESD sensitive components on a properly grounded and protected ESD workbench. When this is not possible, ground yourself to the equipment chassis before touching the boards. Ground yourself with a wrist strap and a resistive connection cord. When neither of the above is possible, touch a conductive part of the equipment chassis with your other hand before touching the boards.
- Always hold the boards by the edges and avoid touching the component contacts.

Regulatory Compliances

Transmitters with LAN or WLAN Interface

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Transmitters with WLAN Interface

This device has been designed to operate with a 2 dBi half-wave antenna. Antennas with a gain greater than 2 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

This Class [B] digital apparatus complies with Canadian ICES-003.

Cet appareil numérique de la classe [B] est conforme à la norme NMB-003 du Canada.

Recycling

Recycle all applicable material.

Dispose of batteries and the unit according to statutory regulations. Do not dispose of with regular household refuse.

Trademarks

HUMICAP® is a registered trademark of Vaisala. Microsoft®, Windows®, Windows® 2000, Windows Server® 2003, Windows® XP, and Windows® Vista are registered trademarks of Microsoft Corporation in the United States and/or other countries.

License Agreement

All rights to any software are held by Vaisala or third parties. The customer is allowed to use the software only to the extent that is provided by the applicable supply contract or Software License Agreement.

Warranty

Vaisala hereby represents and warrants all Products manufactured by Vaisala and sold hereunder to be free from defects in workmanship or material during a period of twelve (12) months from the date of delivery save for products for which a special warranty is given. If any Product proves however to be defective in workmanship or material within the period herein provided Vaisala undertakes to the exclusion of any other remedy to repair or at its own option replace the defective Product or part thereof free of charge and otherwise on the same conditions as for the original Product or part without extension to original warranty time. Defective parts replaced in accordance with this clause shall be placed at the disposal of Vaisala.

Vaisala also warrants the quality of all repair and service works performed by its employees to products sold by it. In case the repair or service works should appear inadequate or faulty and should this cause malfunction or nonfunction of the product to which the service was performed Vaisala shall at its free option either repair or have repaired or replace the product in question. The working hours used by employees of Vaisala for such repair or replacement shall be free of charge to the client. This service warranty shall be valid for a period of six (6) months from the date the service measures were completed.

This warranty is however subject to following conditions:

a) A substantiated written claim as to any alleged defects shall have been received by Vaisala within thirty (30) days after the defect or fault became known or occurred, and

b) The allegedly defective Product or part shall, should Vaisala so require, be sent to the works of Vaisala or to such other place as Vaisala may indicate in writing, freight and insurance prepaid and properly packed and labelled, unless Vaisala agrees to inspect and repair the Product or replace it on site.

This warranty does not however apply when the defect has been caused through

a) normal wear and tear or accident;

b) misuse or other unsuitable or unauthorized use of the Product or negligence or error in storing, maintaining or in handling the Product or any equipment thereof;

c) wrong installation or assembly or failure to service the Product or otherwise follow Vaisala's service instructions including any repairs or installation or assembly or service made by unauthorized personnel not approved by Vaisala or replacements with parts not manufactured or supplied by Vaisala;

d) modifications or changes of the Product as well as any adding to it without Vaisala's prior authorization;

e) other factors depending on the Customer or a third party.

Notwithstanding the aforesaid Vaisala's liability under this clause shall not apply to any defects arising out of materials, designs or instructions provided by the Customer.

This warranty is expressly in lieu of and excludes all other conditions, warranties and liabilities, express or implied, whether under law, statute or otherwise, including without limitation any implied warranties of merchantability or fitness for a particular purpose and all other obligations and liabilities of Vaisala or its representatives with respect to any defect or deficiency applicable to or resulting directly or indirectly from the Products supplied hereunder, which obligations and liabilities are hereby expressly cancelled and waived. Vaisala's liability shall under no circumstances exceed the invoice price of any Product for which a warranty claim is made, nor shall Vaisala in any circumstances be liable for lost profits or other consequential loss whether direct or indirect or for special damages.

CHAPTER 2

PRODUCT OVERVIEW

This chapter introduces the features, advantages, and the product nomenclature of the Vaisala HUMICAP® Humidity and Temperature Transmitter Series HMT330.

Introduction to HMT330

The HMT330 transmitter provides reliable humidity measurement in a wide range of applications. Analog outputs can be chosen between current and voltage signals. Alternatively, digital outputs RS-232 (standard) or RS-422/485 (optional) can be selected.

The quantities measured and calculated by HMT330 are presented in Table 2 below. The quantities available as an option are presented in Table 3 below.

Table 2 Quantities Measured by HMT330

Quantity	Abbreviation	Metric Unit	Non Metric Unit
Relative humidity (RH)	RH	%RH	%RH
Temperature (T)	T	ºC	ºF

Table 3 Optional Quantities Measured by HMT330

Quantity	Abbreviation	Metric Unit	Non Metric Unit
Dewpoint / Frostpoint Temperature ($T_{d/f}$)	TDF	ºC	ºF
Dewpoint Temperature (T_d)	TD	ºC	ºF
Absolute humidity (a)	A	g/m^3	gr/ft^3
Mixing ratio (x)	X	g/kg	gr/lb
Wetbulb temperature (T_w)	TW	ºC	ºF
Humid air volume/ dry air volume (by volume or by weight) (H_2O)	H2O	$ppmv/ppm_w$	ppm_v/ppm_w
Water vapor pressure (P_w)	PW	hPa	lb/in^2
Water vapor saturation pressure (P_{ws})	PWS	hPa	lb/in^2
Enthalpy (h)	H	kJ/kg	Btu/lb
Difference of T and $T_{d/f}$ (ΔT)	DT	ºC	ºF

Basic Features and Options

- Several probes for various applications
- User friendly display
- Calculated output quantities available
- Different probe mounting kits, sensor protection options and probe cable lengths
- Transmitter mounting kits for multiple installation purposes
- Chemical purge for applications where interfering chemicals in the measuring environment pose a risk
- Warmed probe and sensor heating for high humidity conditions (HMT337)
- Additional temperature sensor (HMT337)
- USB connectivity for service connections via the optional USB-RJ45 cable
- Optional modules:
    - isolated power supply
    - power supply module
    - RS-422/485-module
    - LAN and WLAN interfaces
    - data logger module with real time clock
    - additional analog output module
    - relay module

Structure of the Transmitter

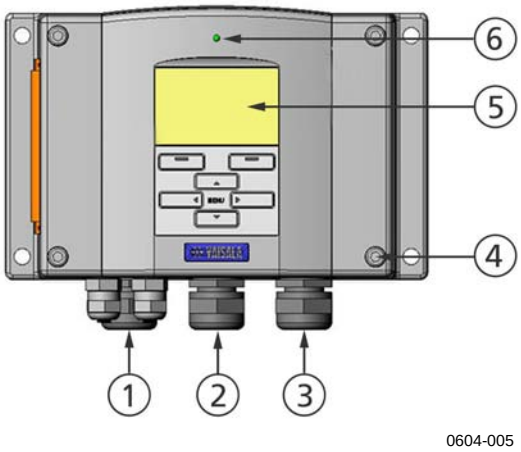

Figure 1 Transmitter Body

The numbers refer to Figure 1:

1 = Signal + powering cable gland
2 = Cable gland for optional module, or WLAN antenna connector
3 = Cable gland for optional module
4 = Cover screw (4 pcs)
5 = Display with keypad (optional)
6 = Cover LED

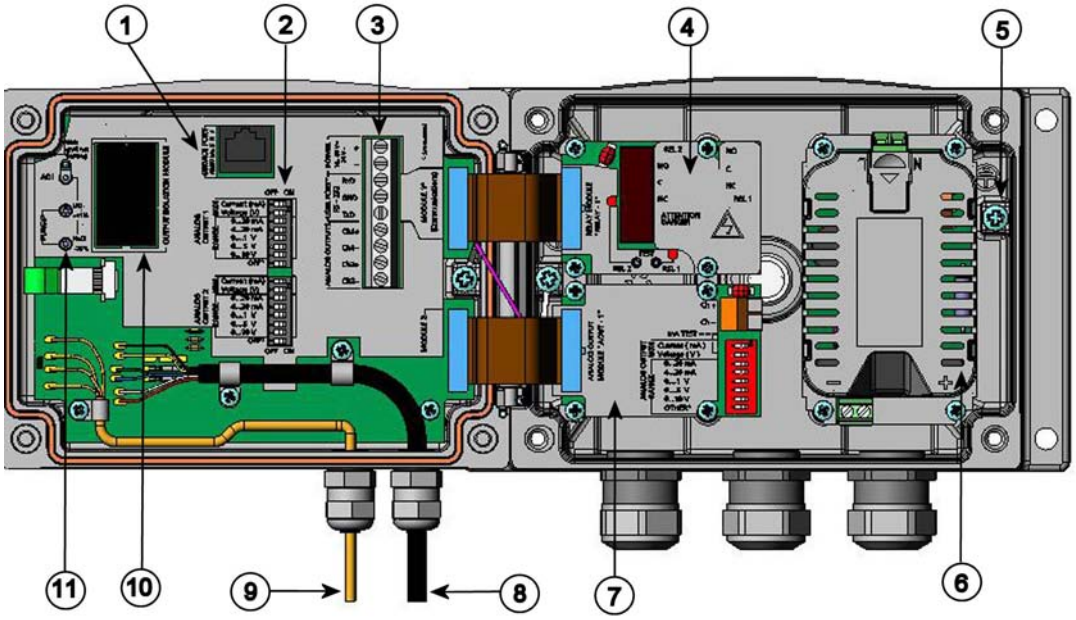

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Figure 2 Inside the Transmitter

The following numbers refer to Figure 2:

1 = Service port (RS-232)
2 = DIP switches for analog output settings
3 = Power supply and signal wiring screw terminals
4 = Relay, data logger, RS-422/485, LAN, or WLAN module (optional)
5 = Grounding connector
6 = Power supply module (optional)
7 = Relay, data logger, or analog output module (optional)
8 = Humidity probe cable
9 = Temperature probe cable (optional)
10 = Output isolation module (optional)
11 = Adjustment buttons (chemical purge buttons) with indicator LED

Probe Options

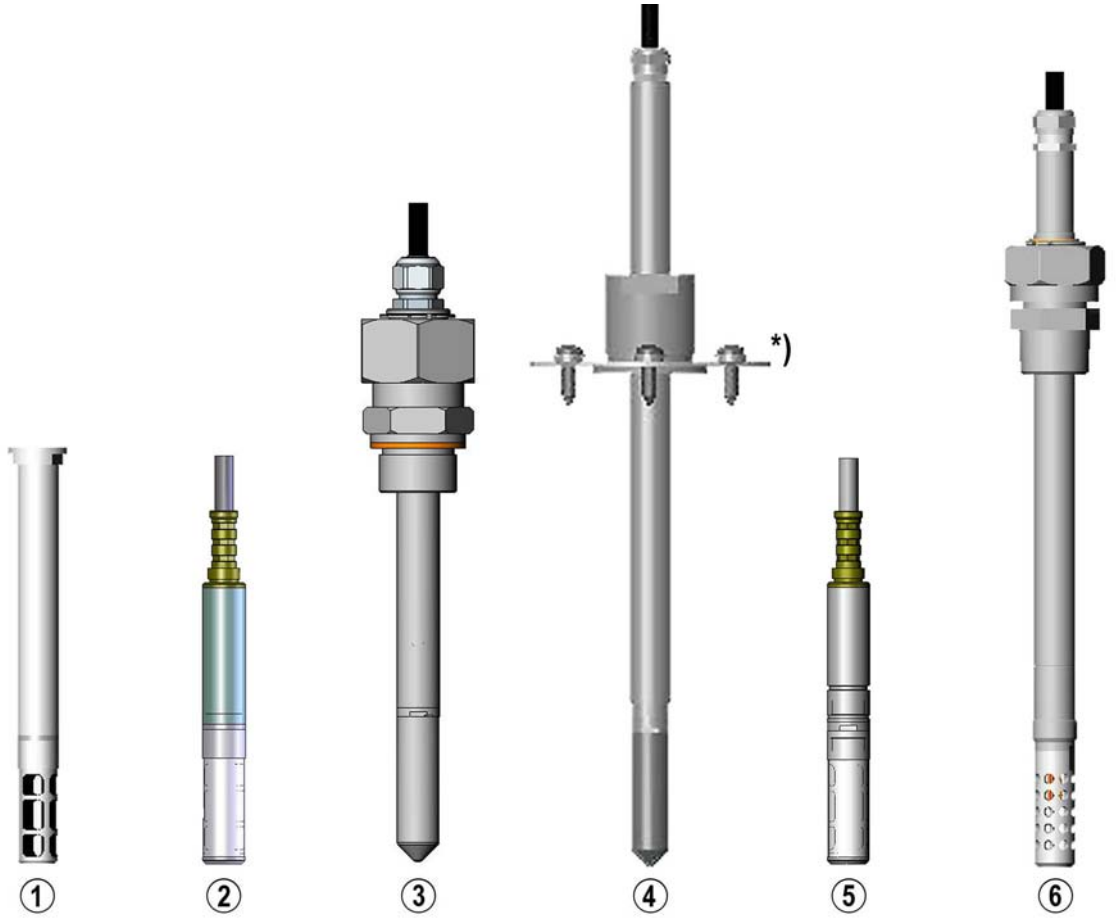


Figure 3 Probe Options

The following numbers refer to Figure 3:

1 = HMT331 for demanding wall-mounted applications
2 = HMT333 for ducts and tight spaces
3 = HMT334 for high pressure and vacuum applications (up to 100 bars)
4 = HMT335 for high temperatures (up to 180 ºC, vapor tight)
*) Flange available as an option
5 = HMT337 for high humidity applications (optional warmed and vapor tight probe)
6 = HMT338 for pressurized pipelines (up to 40 bar)

Probe cable lengths are 2 m, 5 m and 10 m.

Warmed Probe HMT337

Temperature difference between the probe and external environment can cause a risk of condensation on the sensor. A wet probe cannot observe the actual humidity in the ambient air. If the condensed water is contaminated, the life span of the probe may shorten and calibration may change.

HMT337 probe shall be used in applications where condensation can occur due to high humidity and rapid humidity changes. The warmed probe is heated continuously so that its temperature is always higher than in environment. This prevents condensation on the probe. The power consumption of the warmed probe is slightly higher than other probes.

CHAPTER 3

INSTALLATION

This chapter provides you with information that is intended to help you install the product.

Mounting the Housing

The housing can be mounted either without the mounting plate or with optional mounting plates.

Standard Mounting without Mounting Plate

Mount the housing by attaching the transmitter to a wall with 4 screws, for example M6 (not provided).

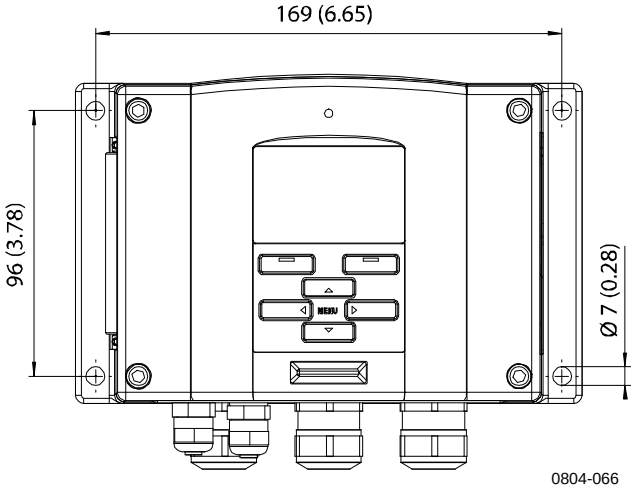


Figure 4 Standard Mounting

Wall Mounting with Wall Mounting Kit

When mounting with wall mounting kit the mounting plate (Vaisala order code 214829) can be installed directly on wall or onto a standard wall box (also US junction box). When wiring through back wall, remove the plastic plug from the wiring hole in the transmitter before mounting.

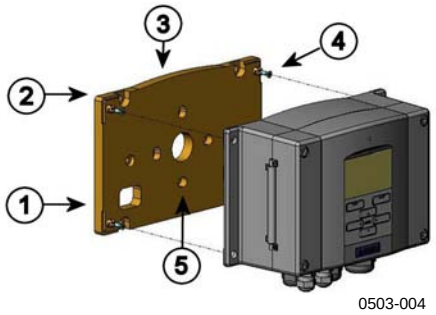


Figure 5 Mounting with Wall Mounting Kit

The following numbers refer to Figure 5:

1 = Plastic mounting plate
2 = Mount the plate to wall with 4 screws M6 (not provided)
3 = The arched side up
4 = Attach the HMT330 to the mounting plate with 4 fixing screws M3 (provided)
5 = Holes for wall/junction box mounting

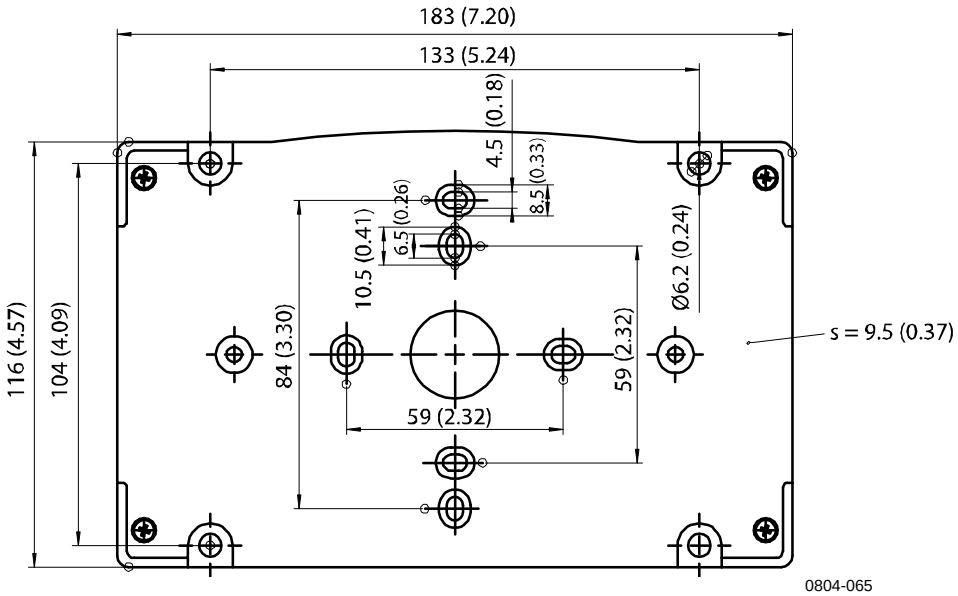
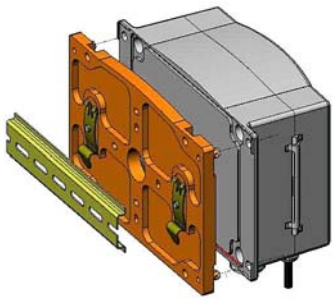


Figure 6 Dimensions of the Plastic Mounting Plate (mm/inch)

Mounting with DIN Rail Installation Kit

DIN rail installation kit includes a wall mounting kit, 2 clip-fasteners and 2 screws M4 × 10 DIN 7985 (Vaisala order code: 215094).

1. Attach two spring holders to the plastic mounting plate by using the screws provided in the installation kit.
2. Attach the HMT330 to the plastic mounting plate with the 4 screws provided for that purpose.
3. Press the transmitter onto the DIN rail so that the clip-fasteners snap into the rail.



0503-002

Figure 7 Mounting with the DIN Rail Installation Kit

Pole Installation with Installation Kit for Pole or Pipeline

Installation kit for pole or pipeline (Vaisala order code: 215108) includes the metal mounting plate and 4 mounting nuts for pole mounting. When mounting, the arrow in the metal mounting plate must point upwards**;** see Figure 10 on page 27 below.

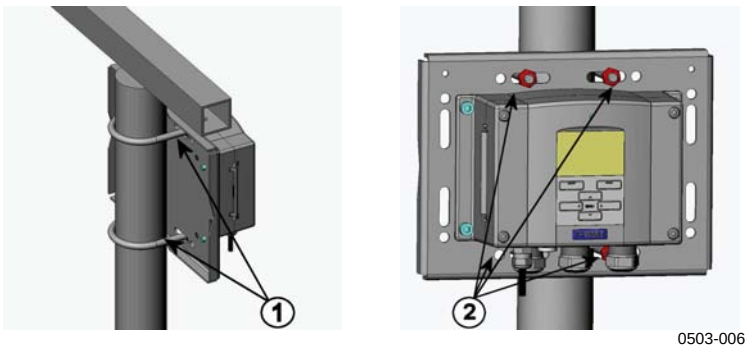


Figure 8 Vertical Pole

The following numbers refer to Figure 8:

1 = Fixing brackets (2 pcs) M8 (provided) for 30 ... 102 mm poles.
2 = Mounting nuts M8 (4 pcs)

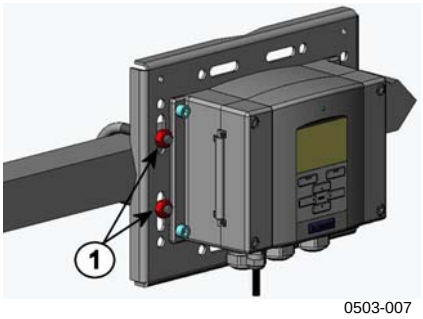


Figure 9 Horizontal Pole

The following number refers to Figure 9:

1 = Mounting nuts M8 (4 pcs)

Metal mounting plate is included in rain shield with installation kit and installation kit for pole or pipeline.

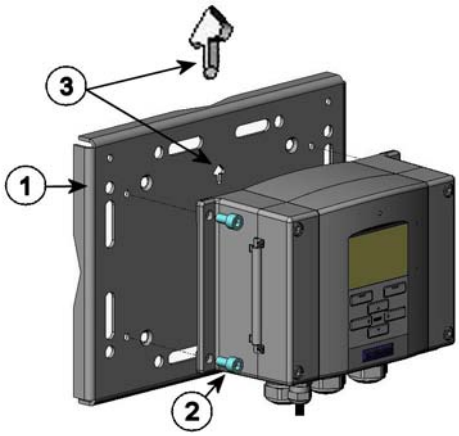


Figure 10 Mounting with Metal Wall Mounting Plate

The following numbers refer to Figure 10:

1 = Mount the plate to wall with 4 screws M8 (not provided)
2 = Attach the HMT330 to the mounting plate with 4 fixing screws M6 (provided)
3 = Note the position of the arrow when mounting. This side must be up when mounting.

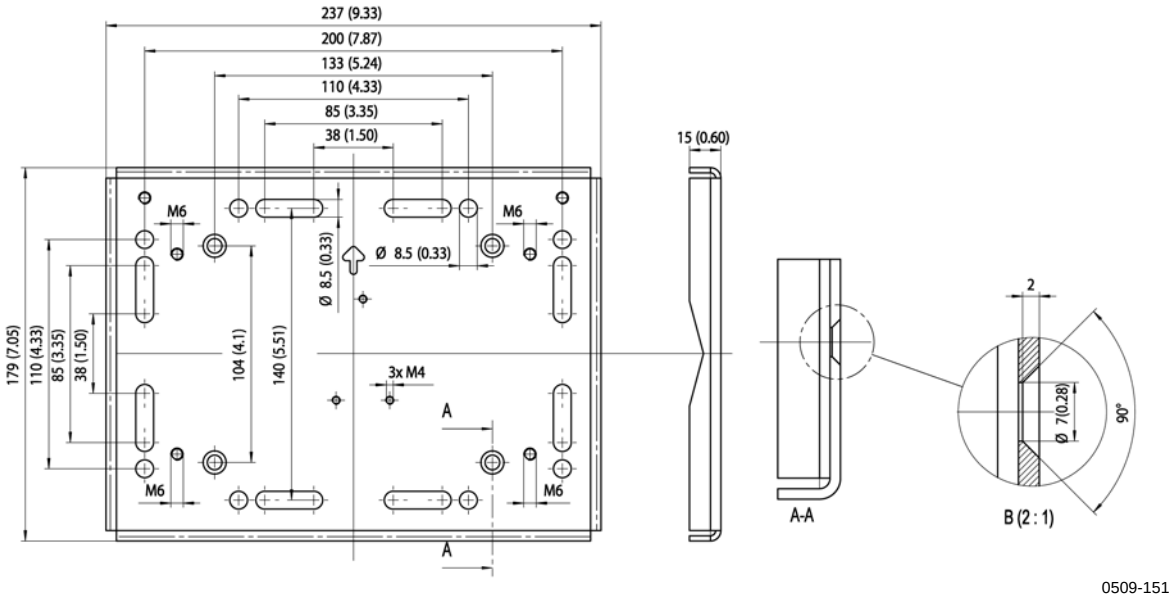


Figure 11 Dimensions of the Metal Mounting Plate (mm/inch)

Mounting Rain Shield with Installation Kit

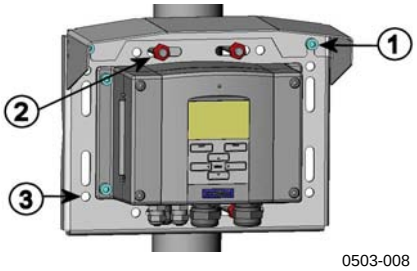


Figure 12 Mounting the Rain Shield with the Installation Kit

The following numbers refer to Figure 12:

1 = Assemble the rain shield with the installation kit (Vaisala order code: 215109) to the metal mounting plate with 2 (M6) mounting screws (provided).
2 = Assemble the mounting plate with rain shield with installation kit to the wall or to the pole (see pole installation).
3 = Assemble the HMT330 to the mounting plate with 4 fixing screws (provided).

Panel Mounting Frame

To enable a neat and dirt free embedded installation of the transmitter, a panel mounting frame is available as an option (Vaisala order code: 216038). The frame is a thin, flexible plastic frame for the transmitter, with adhesive tape on one side.

The frame is used to hide any rough edges of the installation hole, and provide a more finished look. Note that the panel mounting frame is not intended to bear the weight of the transmitter, and does not include any mounting supports.

Use the panel mounting frame as follows:

1. Use the frame as a template to mark the required size for the installation hole in the panel.
2. Cut the hole in the panel.
3. Mount the transmitter through the panel with suitable supports.

4. Remove the paper protecting the adhesive tape on the frame, and attach the frame around the transmitter. Refer to Figure 13 below.

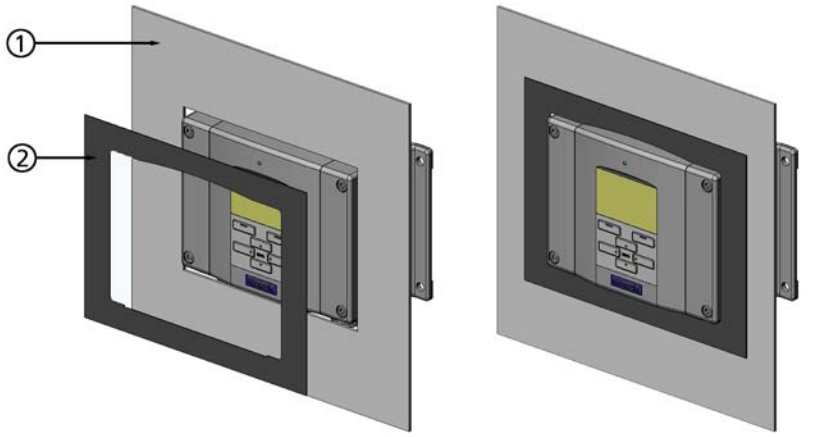


Figure 13 Panel Mounting Frame

The following numbers refer to Figure 13:

1 = Panel (not included)
2 = Panel mounting frame

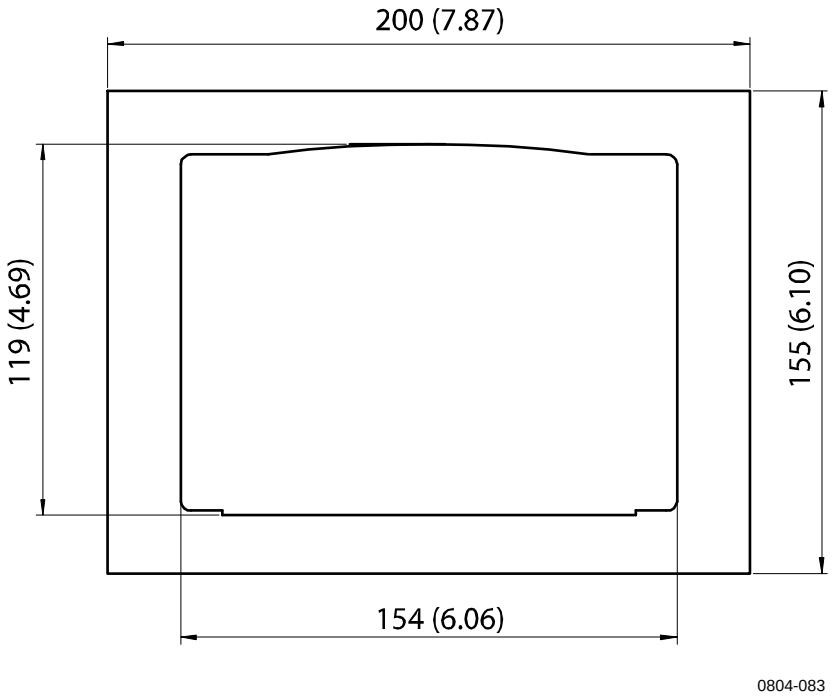


Figure 14 Panel Mounting Dimensions (mm/inch)

Wiring

Cable Bushings

A single electrical cable with screen and three to ten wires is recommended for power and analog/serial connections. The cable diameter should be 8 ... 11 mm. The number of cable bushings depends on the transmitter options. See the following recommendations for the cable bushings:

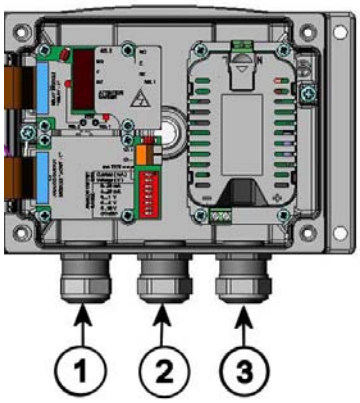


Figure 15 Cable Bushings

The following numbers refer to Figure 15:

1 = Cable for signal/powering Ø8 ... 11 mm
2 = Cable for optional module Ø8 ... 11 mm
3 = Cable for optional power supply module Ø8 ... 11 mm

NOTE	When there is high electric noise level (for example, near a powerful electric motor) in the operating environment it is recommended to use shielded cable or take care that the signal cables are separated from other cables.

Grounding the Cables

Ground the screen of the electrical cable properly to achieve the best possible EMC performance.

Fig. 1

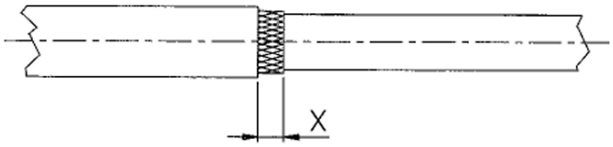


Fig. 2

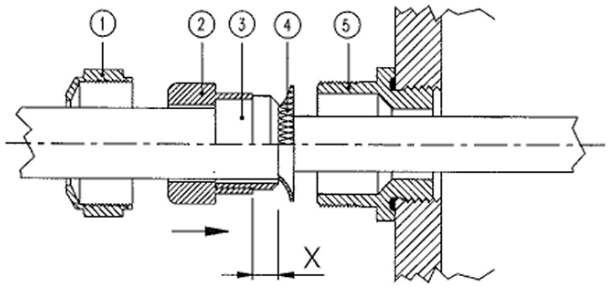
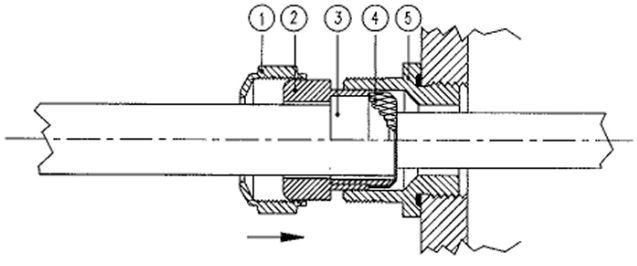


Fig. 3



0504-049

Figure 16 Grounding the Screen of Electrical Cable

1. Cut back outer sheath to desired length.
2. Cut back screen braiding or screen foil to dimension X (see figure 3).
3. Push the domed cap nut (item 1) and the seal insert with contact socket of the gland (item 2+3) onto the cable as shown in the diagram.
4. Bend over the screen braiding or screen foil by about 90º (item 4).
5. Push the seal insert with the contact socket of the gland (item 2+3) up to the screen braiding or screen foil.
6. Mount lower part (item 5) on the housing.
7. Push the seal with the contact socket of the gland and (item 2+3) flush into the lower part (item 5).
8. Attach the domed cap nut (item 1) onto the lower part (item 5).

Grounding the Transmitter Housing

In case you need to ground the transmitter housing, the grounding connector is found inside the housing, see Figure 2 on page 20. Note that the probe is connected to the same potential as the housing. Make sure that different groundings are made to the same potential. Otherwise harmful ground currents may be generated.

If it is needed to have galvanic isolation of the power supply line from the output signals, the HMT330 can be ordered with an optional output isolation module. This module prevents harmful grounding loops.

Signal and Power Supply Wiring

When connecting the transmitter with 8-pin connector, see section 8-Pin Connector on page 61. When wiring the power supply module, see section Power Supply Module on page 45.

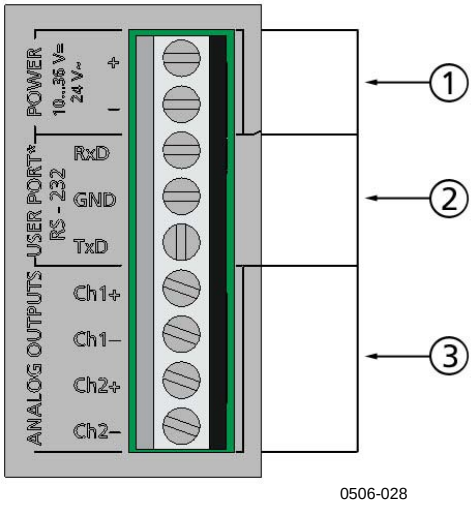


Figure 17 Screw Terminal Block on Motherboard

The following numbers refer to Figure 17:

1 = Power supply terminals 10 ... 35 VDC, 24 VAC
2 = User port (RS-232 terminals)
3 = Analog signal terminals

WARNING Make sure that you connect only de-energized wires.

1. Unfasten the four cover screws and open the transmitter cover.
2. Insert the power supply wires and signal wires through the cable bushing in the bottom of the transmitter; see the grounding instructions in the previous sections.
3. Connect the analog output cables to terminals: **Ch1 +, Ch1-, Ch2+, Ch2-**. Connect the RS-232 user port cables to terminals RxD, GND and TxD. For more information about the RS-232 connection refer to section Serial Line Communication on page 72.

4. When wiring the optional modules, see the corresponding section for instructions:
   - RS-422/485 Interface on page 54
   - Relays on page 52
   - Third Analog Output on page 50
   - LAN Interface on page 56
   - WLAN Interface on page 57
5. Connect the power supply wires to the connectors: **POWER 10 ... 35V+ 24V~ (+)** and (-) terminals. If you are using 24 VAC power supply, see the note below before connecting the supply wires.
6. Turn on the power. The indicator led on the cover lit continuously during normal operation.
7. Close the cover and fasten the cover screws. The transmitter is ready for use.

Connections to a 24 VAC Power Supply

Separate floating supply for each transmitter is recommended (see the upper part of Figure 18 on page 35). If you have to connect several transmitters or other instruments to one AC supply, the phase (~) must always be connected to the (+) connector of each transmitter (see the lower part of Figure 18).

CAUTION

24 VAC POWER SUPPLY USE

To prevent fire and/or damage, if either 24 VAC wire is **grounded** or **connected to a "-", "0", or "GND" terminal** of any other device, you must **connect the same wire on the "-" terminal** also on this instrument.

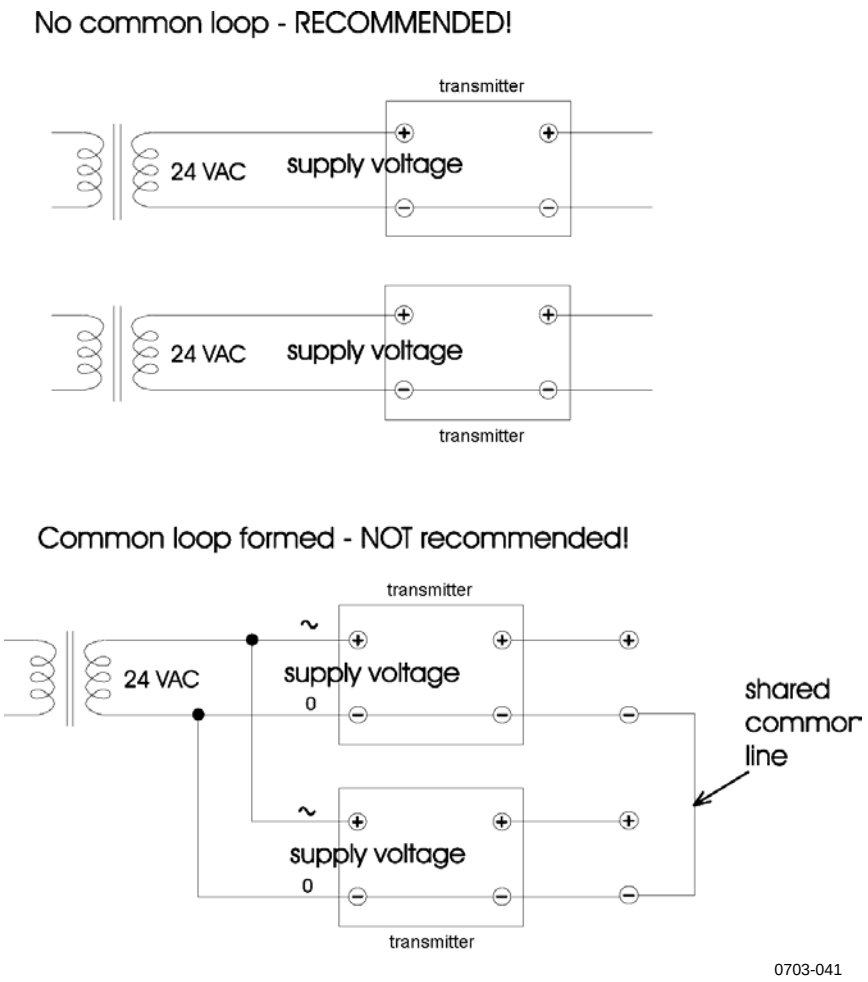


Figure 18 Connections to 24 VAC Power Supply

Probe Mounting

In humidity measurement and especially in calibration it is essential that temperature of the probe and measuring environment is the same. Even a small difference in temperature between the environment and the probe causes an error. As the curve below shows, if the temperature is +20 °C and the relative humidity 100 %RH, a difference of ±1 °C between the environment and the probe causes an error of ±6 %RH.

The graph below illustrates the measurement error at 100 %RH when the difference between the ambient and sensor temperature is 1 °C.

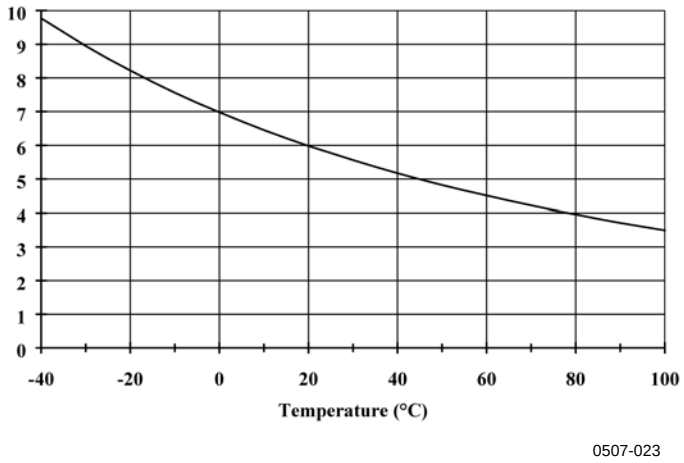


Figure 19 Measurement Error at 100 %RH

General Instructions for Probes with a Cable

Mount the probes with a cable **horizontally**; this way, any water condensing on the tube cannot flow onto the sensor.

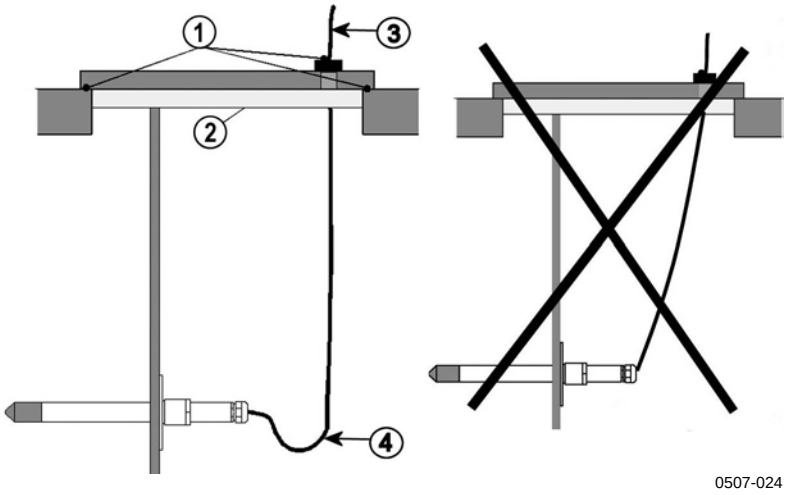


Figure 20 Horizontal Mounting of Probe

The following numbers refer to Figure 20:

1 = To be sealed.
2 = To be insulated.
3 = Insulate the cable.
4 = Let the cable hang loosely. This prevents condensed water running to the probe along the cable.

When there is no alternative but to install the probe in the process **vertically,** the point of entry must be carefully insulated. The cable must also be allowed to hang loosely as this prevents any condensed water from running onto the probe along the cable.

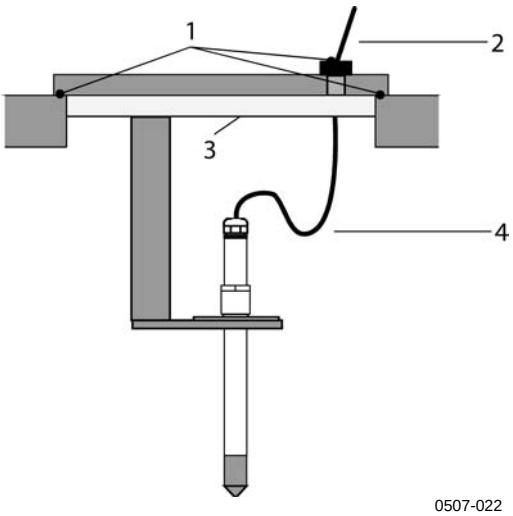


Figure 21 Vertical Mounting of Probe

The following numbers refer to Figure 21:

1 = To be sealed.
2 = Insulate the cable.
3 = To be insulated.
4 = Let the cable hang loosely. This prevents condensed water running to the sensor along the cable.

NOTE Please do not attach a heated probe (HMT337) to metal structures to avoid condensation problems caused by heat conduction along the metal.

If the process temperature is much higher than that of the environment, the whole probe and preferably plenty of cable must be inside the process. This prevents measuring inaccuracy caused by heat conduction along the cable.

When mounted on the side of a duct or channel, the probe must be inserted from the side of the duct. If this is not possible and the probe must be inserted from the top, the point of entry must be carefully insulated.

For Vaisala probe installation kits and some installation examples, see Appendix A on page 165.

HMT333 for Ducts and Tight Spaces

The HMT333 is a small size (ø = 12mm) general-purpose probe suitable for ducts and channels with the installation kit available from Vaisala.

The HMT333 provides for two measuring range options. The first probe version is equipped with a flexible cable and can be used when measuring in environments up to 80 ºC. The second version is suitable for measuring in environments up to 120 ºC.

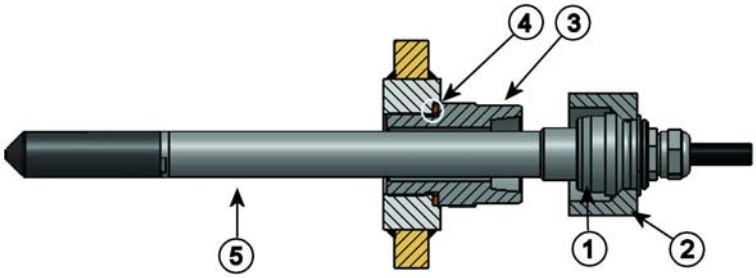
See Appendix A on page 165 for the following probe installation kits for HMT333 and installation examples.

- Duct mounting kit
- Cable gland.

HMT334 for High Pressure and Vacuum Applications

The HMT334 probe is for the dewpoint measurements in pressurized rooms and industrial processes. The probe is provided with a nut, a fitting screw and a sealing washer. Keep the fitting screw and the nut in place on the body of the probe during handling to prevent damage to the highly polished surface of the probe. Follow the instructions below to achieve a leak-tight assembly:

1. Remove the fitting screw from the nut and the probe.
2. Attach the fitting screw to the chamber wall with a sealing washer. Tighten the fitting screw into the threaded sleeve with a torque spanner. The tightening torque is 150 ± 10 Nm (110 ± 7 ft-lbs).
3. Insert the body of the probe into the fitting screw and attach the nut manually to the fitting screw so that the connection feels tight.
4. Mark both the fitting screw and the nut hex.



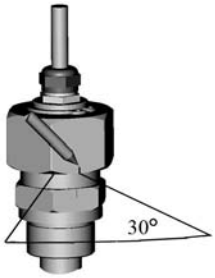
0506-029

Figure 22 HMT344 Probe

The following numbers refer to Figure 22:

1 = Tightening cone
2 = Nut
3 = Fitting screw, M22x1.5 or NPT 1/2"
4 = Sealing washer
5 = Probe; Ø12 mm.

5. Tighten the nut a further 30º (1/12) turn or if you have a torque spanner tighten it with a torque of 80 ± 10 Nm (60 ± 7 ft-lbs).



0503-034

Figure 23 Tightening the Nut

NOTE	When re-tightening the nut after detachment the nut must be tightened without increased effort.

6. Clean and grease the tightening cone of the fitting screw after every tenth detachment. Change the sealing washer every time the fitting screw is detached. Use high-vacuum grease (for example Dow Corning) or similar grease.

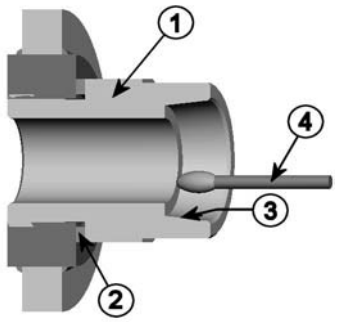


Figure 24 Cleaning of Tightening Cone

The following numbers refer to Figure 24:

1 = Fitting screw
2 = Sealing washer
3 = Tightening cone
4 = Clean cotton stick

CAUTION	In pressurized processes it is essential to tighten the supporting nuts and screws very carefully to prevent loosening of the probe by the action of pressure.

NOTE	When installed in a process with a pressure differing from normal atmospheric pressure, please enter the pressure value of the process (in hPa or mbar) into the transmitter memory via the serial line (see command PRES and XPRES on page 96) or by using display/keypad.

HMT335 for High Temperatures

HMT335 is installed similarly than the HMT333 probe but without the supporting bar. Refer to Appendix A on page 165 for more information on the duct installation kit for HMT335.

To avoid incorrect humidity readings, the temperature differences between inside and outside of the duct must not be remarkable.

HMT337 for High Humidity Applications

The HMT337 is for environment where relative humidity is very high, near saturation. The warmed probe prevents the saturation of the sensor. An additional temperature probe is also available.

See Appendix A on page 165 for a presentation of the following probe installation kits for HMT337 with installation examples:

- Duct mounting kit
- Cable gland
- Pressure tight Swagelok connector
- Vaisala's Meteorological Installation kit

The installation kits are available for both humidity and temperature probe.

Temperature Probe (Optional)

An additional temperature probe is available to measure the ambient temperature when the HMT337 (with probe warming) is used. The additional temperature probe allows you to measure other humidity quantities apart from dewpoint and mixing ratio. The temperature probe must be connected to the transmitter at the factory. Do not cut and re-connect the cable yourself.

You must install the additional temperature probe in the same measurement environment as the HMT337 probe. Make sure that heat does not transfer from the warmed probe to the temperature probe. For an example installation, refer to section Example of Installation Through Roof on page 171.

HMT338 for Pressurized Pipelines

Due to the sliding fit the HMT338 is easy to install into and remove from the pressurized process. The probe is especially suitable for the measurements in pipelines. See section Ball Valve Installation Kit for HMT338 on page 172.

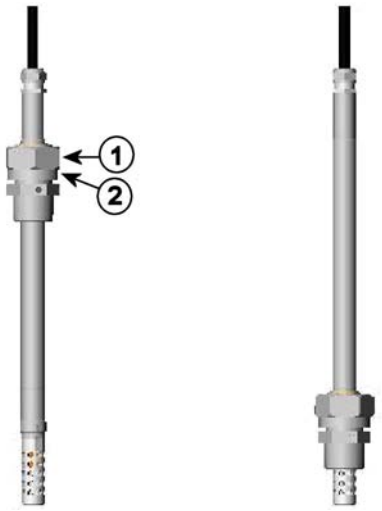


Figure 25 HMT338 Probe

The following numbers refer to Figure 25:

1 = Clasp nut, 24 mm hex nut
2 = Fitting body, 27 mm hex head

The following two fitting body options are available:

- Fitting Body ISO1/2 solid structure
- Fitting Body NPT1/2 solid structure

Table 4 HMT338 Probe Dimensions

Probe type	Probe Dimension	Adjustment Range
Standard	178 mm	120 mm
Optional	400 mm	340 mm

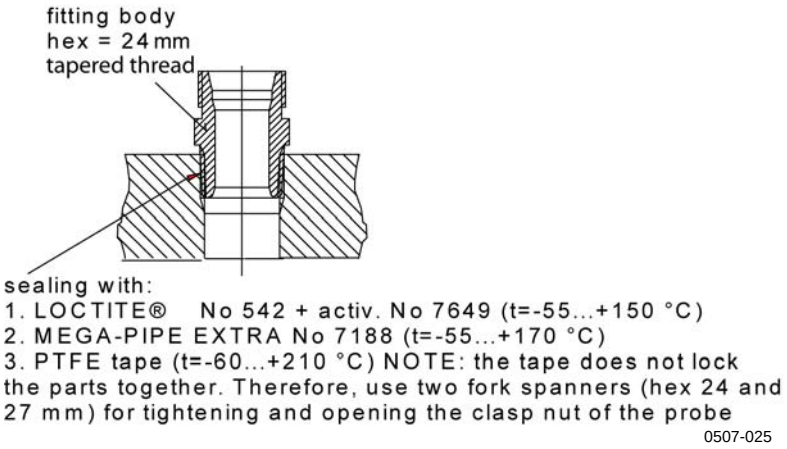

fitting body
hex = 24 mm
tapered thread
sealing with:
1. LOCTITE® No 542 + activ. No 7649 (t=-55...+150 °C)
2. MEGA-PIPE EXTRA No 7188 (t=-55...+170 °C)
3. PTFE tape (t=-60...+210 °C) NOTE: the tape does not lock the parts together. Therefore, use two fork spanners (hex 24 and 27 mm) for tightening and opening the clasp nut of the probe
0507-025

Figure 26 Sealing of Fitting Body into Process

Tightening the Clasp Nut

1. Adjust the probe to a suitable depth according to the type of installation.
2. Tighten the clasp nut first manually.
3. Mark the fitting screw and the clasp nut.
4. Tighten the nut a further 50 -60º (ca. 1/6 turn) with a wrench. If you have suitable torque spanner, tighten the nut to max 45 ± 5 Nm (33 ± 4 ft-lbs).

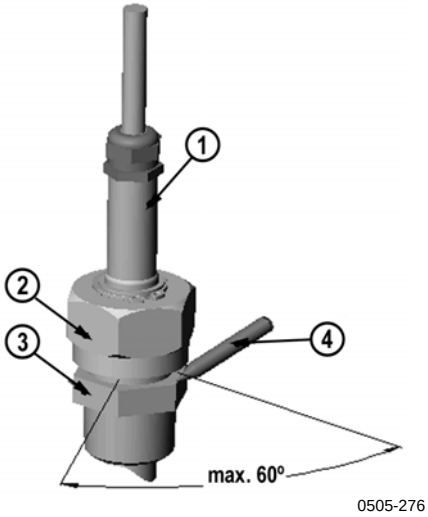


Figure 27 Tightening the Clasp Nut

The following numbers refer to Figure 27 on page 44:

1 = Probe
2 = Clasp nut
3 = Fitting screw
4 = Pen

NOTE	Take care not to over tighten the clasp nut to avoid difficulties when opening it.

CAUTION	Take care not to damage the probe body. A damaged body makes the probe less tight and may prevent it from going through the clasp nut.

CAUTION	In pressurized processes it is essential to tighten the supporting nuts and screws very carefully to prevent loosening of the probe by the action of pressure.

NOTE	When installed in a process with a pressure differing from normal atmospheric pressure, please enter the pressure value of the process (in hPa or mbar) into the transmitter memory via the serial line (see command PRES and XPRES on page 96) or by using display/keypad.

Optional Modules

Power Supply Module

The AC (mains) power connection may be connected to the power supply module only by an authorized electrician. A readily accessible disconnect device shall be incorporated in the fixed wiring.

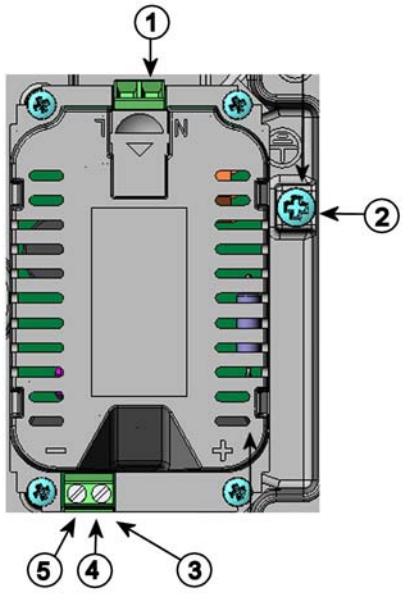


Figure 28 Power Supply Module

The following numbers refer to Figure 28:

1 = Connect AC (mains) voltage wires to these terminals
2 = Grounding terminal
3 = In case the module is not installed in the factory: Connect wires from these terminals to the POWER 10 ... 36V 24V terminals of the mother board.
4 = +
5 = -

Installation

1. Disconnect the power and open the transmitter cover.
2. Remove the protective plug from the cable gland and thread the wires. In case the power supply module is installed in the factory, continue with the step 5.
3. Attach the power module to the bottom of the housing with four screws. See the position Figure 2 on page 20.
4. Connect the wires from the terminals of the power supply module marked with + and - to the terminals **POWER 10 ... 35 V** 24V on the motherboard of the transmitter.
5. Connect the AC mains voltage wires to the power supply module terminals marked with **N** and **L**.
6. Attach the grounding wire to the grounding terminal on the right-hand side of the transmitter.
7. Connect the power. The LED on the cover of the transmitter is lit continuously during normal operation.

WARNING	Do not detach the power supply module from the transmitter when the power is on.

WARNING	Do not connect the mains power to power supply module when it is not installed in the transmitter.

WARNING	Always connect the protective ground terminal.

Warnings

Dieses Produkt entspricht der Niederspannungsrichtlinie (73/23 EWG).

- Das Netzmodul darf nur von einem dazu befugten Elektriker angeschlossen werden.
- Trennen Sie das Netzmodul nicht vom Messwertgeber, wenn der Strom eingeschaltet ist.
- Verbinden Sie das Netzmodul nur mit der Spannungsquelle, wenn es im Messwertgeber HMT330 montiert ist.
- Das Erdungskabel muss zum Schutz immer angeschlossen sein.

Ce produit est conforme à la Directive relative à la Basse Tension (73/23 EEC).

- Seul un électricien compétent est habilité à raccorder le module d'alimentation au secteur.
- Ne pas détacher le module d'alimentation du transmetteur lorsqu'il est en service.
- Ne pas raccorder le secteur au module d'alimentation lorsque celui-ci n'est pas installé dans le transmetteur HMT330.
- Toujours raccorder un bornier de protection à la terre.

Tämä tuote on pienjännitedirektiivin (73/23 EEC) mukainen.

- Vaihtovirtaliitännän saa kytkeä tehonsyöttömoduuliin ainoastaan valtuutettu sähköasentaja
- Älä irrota tehonsyöttömoduulia lähettimestä, kun virta on kytkettynä.
- Älä kytke verkkovirtaa tehonsyöttömoduuliin, jos kyseistä moduulia ei ole asennettu HMT330 lähettimeen.
- Kytke aina maadoitusliittimet.

Denna produkt uppfyller kraven i direktivet om lågspänning (73/23 EEC).

- Nätanslutningen (växelströmsanslutningen) får bara anslutas till strömförsörjningsmodulen av en behörig elektriker.
- Ta inte loss strömförsörjningsmodulen från mätaren när strömmen är på.
- Anslut inte strömförsörjningsmodulen till nätet när den inte är installerad i HMT330-mätaren
- Anslut alltid en skyddande jordningsplint.

Questo prodotto é conforme alla Direttiva sul basso voltaggio (73/23 CEE).

- La conduttura elettrica puó essere collegata al modulo di alimentazione elettrica soltanto da un elettricista autorizzato.
- Non staccare l´alimentazione elettrica dal trasmettitore quando é acceso.
- Non collegare la corrente elettrica al modulo di alimentazione elettrica se non é installato nel trasmettitore HMT330.
- Collegare sempre il morsetto protettivo a terra!

Dette produkt er i overensstemmelse med direktivet om lavspænding (73/23 EØS).

- Netstrømskoblingen til må kun tilsluttes strømforsyningsmodulet af en autoriseret elinstallatør
- Strømforsyningsmodulet må ikke løsgøres fra senderen, mens spændingen er sluttet til.
- Slut ikke netspændingen til strømforsyningsmodulet, når det ikke er installeret i HMT330-senderen
- Forbind altid den beskyttende jordklemme!

Dit product voldoet aan de eisen van de richtlijn 73/23 EEG (Laagspanningsrichtlijn).

- De stroom kan aan de stroomtoevoer module aangesloten worden alleen door een bevoegde monteur.
- Het is niet toegestaan de stroomtoevoer module van de transmitter los te koppelen wanneer de stroom aan is.
- Het is niet toegestaan de stroom aan de stroomtoevoer module aan te sluiten als deze niet in een HMT330-transmitter is gemonteerd.
- Altijd beschermend aardcontact aansluiten!

Este producto cumple con la directiva de bajo voltaje (73/23 EEC).

- La conexión de la alimentación principal al módulo de alimentación sólo puede realizarla un electricista autorizado.
- No desenchufe el módulo de alimentación del transmisor cuando esté encendido.
- No conecte la alimentación principal al módulo de alimentación cuando no esté instalado en el transmisor HMT330.
- Conecte siempre el terminal de protección de conexión a tierra.

See toode vastab madalpinge direktiivile (73/23 EEC).

- Voolukaabli võib vooluallika mooduli külge ühendada ainult volitatud elektrik.
- Ärge ühendage vooluallika moodulit saatja küljest lahti, kui vool on sisse lülitatud.
- Ärge ühendage voolukaablit vooluallika mooduli külge, kui seda pole HMT330-tüüpi saatjasse paigaldatud.
- Ühendage alati kaitsev maandusklemm!

Ez a termék megfelel a Kisfeszültségű villamos termékek irányelvnek (73/23/EGK).

- A hálózati feszültséget csak feljogosított elektrotechnikus csatlakoztathatja a tápegységmodulra.
- A bekapcsolt távadóról ne csatolja le a tápegységmodult.
- Ne csatlakoztassa a hálózati feszültséget a tápegységmodulhoz, ha az nincs beépítve a HMT330 távadóba.
- Feltétlenül csatlakoztasson földelő védőkapcsot!

Šis produktas atitinka direktyvą dėl žemos įtampos prietaisų (73/23/EB).

- Elektros tinklą su energijos tiekimo moduliu sujungti gali tik įgaliotas elektrikas.
- Niekada neišimkite energijos tiekimo modulio iš siųstuvo, kai maitinimas yra įjungtas.
- Jei energijos tiekimo modulis nėra įmontuotas HMT330 siųstuve, nejunkite jo į elektros tinklą.
- Visada prijunkite prie apsauginės įžeminimo jungties!

Šis produkts atbilst Zemsprieguma direktīvai (73/23 EEC).

- Strāvas pieslēgumu var pieslēgt pie barošanas avota moduļa tikai autorizēts elektriķis.
- Neatvienot barošanas avota moduli no raidītāja, kad pieslēgta strāva.
- Nepievienot strāvu barošanas avota modulim, ja tas nav uzstādēts HMT330 raidītājā
- Vienmēr pievienot aizsargājošu iezemētu terminālu !

Ten produkt spełnia wymogi Dyrektywy niskonapięciowej (73/23 EEC).

- Napięcie zasilające powinno zostać podłączone do modułu zasilacza tylko przez wykwalifikowanego elektryka.
- Nie wolno odłączać modułu zasilacza od nadajnika, kiedy zasilanie jest włączone.
- Nie wolno podłączać napięcia zasilającego do modułu zasilacza, kiedy nie jest on zamontowany w nadajniku HMT330.
- Zawsze należy podłączać zabezpieczający zacisk uziemiający!

Tento výrobek vyhovuje Směrnici pro nízké napětí (73/23 EEC).

- Připojení síťového napájení k napájecímu modulu smí provádět pouze oprávněný elektrikář.
- Neodpojujte napájecí modul od snímače při zapnutém napájení.
- Nepřipojujte síťové napájení k napájecímu modulu, pokud není instalován ve snímači HMT330.
- Vždy zapojte ochrannou zemnící svorku!

Galvanic Isolation for Output

If galvanic isolation of the power supply line from the output signals is needed, HMT330 can be ordered with optional output isolation module. This module prevents harmful grounding loops.

NOTE	Output isolation module is not needed when using the power supply module.

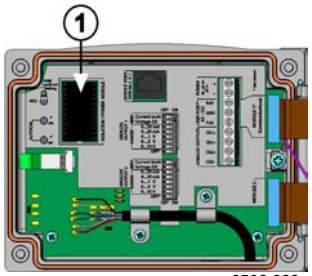


Figure 29 Galvanic Output Isolation Module

The following number refers to Figure 29:

1 = Output isolation module

Third Analog Output

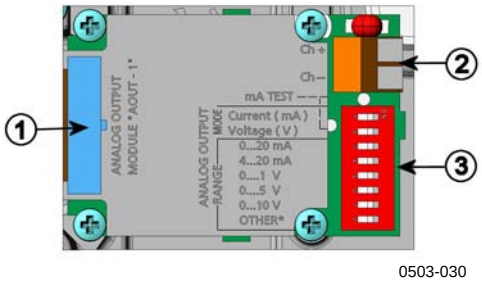


Figure 30 Third Analog Output

The following numbers refer to Figure 30:

1 = Flat cable pins
2 = Screw terminals for signal line
3 = DIP switches to select the output mode and range

Installation and Wiring

1. Disconnect the power. In case the analog output module is installed in the factory, continue with the step 4.
2. Open the transmitter cover and fasten the analog output module to the position for MODULE 2 with four screws. Refer to Figure 2 on page 20.
3. Connect the flat cable between the analog output module and the motherboard's connector for MODULE 2.
4. Take out the protective plug from the cable gland and thread the wires.
5. Connect the wires to the screw terminals marked with **Ch+** and **Ch-** .
6. Select the current/voltage output by setting ON either of the switches 1 or 2.
7. Select the range by setting ON one of the switches 3 ... 7.

NOTE

Only one of the switches 1 and 2 can be ON at a time.

Only one of the switches 3 ... 7 can be ON at a time.

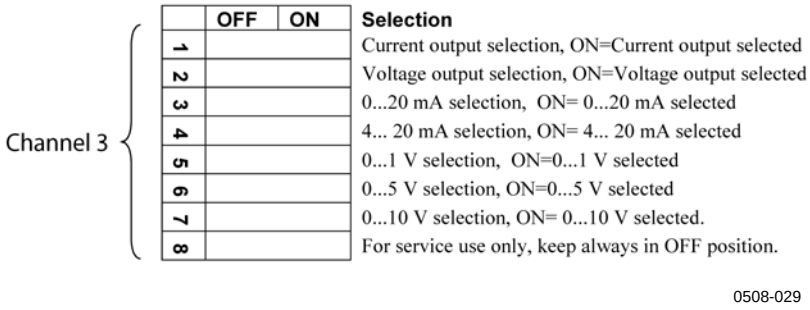


Figure 31 Third analog output selection

8. Connect the power.
9. Select the quantity and scale the channel via the serial line or display/keypad, see section Analog Output Quantities on page 111. For testing the analog output, see section Analog Output Tests on page 113. For fault indication setting, see section Analog Output Fault Indication Setting on page 114.

Relays

HMT330 can be equipped with one or two configurable relay modules. Each module contains two configurable relays. See the contact ratings in section Technical Specifications of Optional Modules on page 155.

Installation and Wiring

1. Disconnect the power and open the transmitter cover. In case the relay-module is installed in the factory, continue with step 5.
2. Attach the relay module to the bottom of the housing with four screws. See the position in Figure 2 on page 20.
3. When the mains power is in use attach the grounding wire to the grounding terminal.
4. Connect the flat cable between the relay module and the **MODULE 1** or **MODULE 2** pins of the motherboard.
5. Take out the protective plug from the cable gland and thread the relay wires.
6. Connect the wires to the screw terminals: NO, C, NC. Refer to section Selecting the Activation State of the Relay below.
7. Connect the power and close the cover.

Selecting the Activation State of the Relay

The middlemost C terminal and either one of the terminals NO/NC must be connected. The polarity can be freely selected.

NO Normally open
C Common relay
NC Normally closed

Relay NOT activated: C and NC outputs are closed, NO is open
Relay IS activated: C and NO outputs are closed, NC is open.

NOTE For instructions on how to operate the relay (for example, select quantity for the relay output and set the relay setpoints) see section Operation of Relays on page 115.

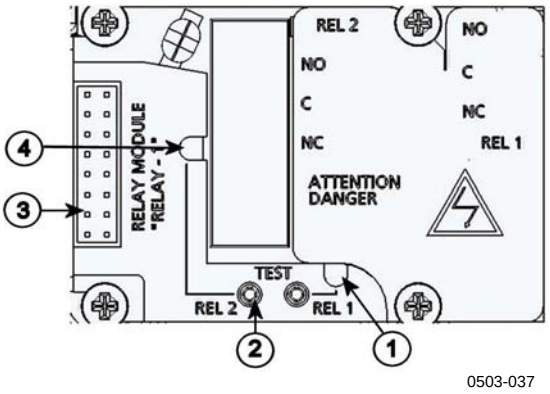


Figure 32 Relay Module

The following numbers refer to Figure 32:

1 = Indication led for the relay 1 or 3
2 = Relay test buttons
3 = Flat cable pins
4 = Indication led for relay 2 or 4

WARNING	The relay module may contain dangerous voltages even if the transmitter power has been disconnected. Before opening the transmitter you must switch off **both** the transmitter **and** the voltage connected to the relay terminals.

WARNING	Do not connect the mains power to relay unit without grounding the transmitter.

RS-422/485 Interface

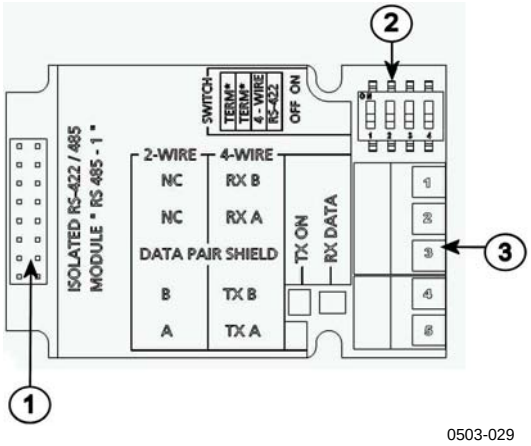


Figure 33 RS-485 Module

The following numbers refer to Figure 33:

1 = Flat cable pins
2 = Selection switches
3 = Screw terminals for wiring

Installation and Wiring

1. Disconnect the power. In case the RS-485-module is installed in the factory, continue with the item 4.
2. Open the transmitter cover and attach the RS-485 module to the bottom of the housing with four screws.
3. Connect the flat cable between the RS-485 module and the motherboard's pins **MODULE1 (Communications)**.
4. Pull the network wirings through the cable gland.
5. Connect the twisted pair wires (1 or 2 pairs) to the screw terminals as presented in Table 5 below:

Table 5 Connecting the Twisted Pair Wires to the Screw Terminals

Screw terminal	Data line (2-wire RS-485)	Data line (4-wire RS-485/422)
1	(not connected)	RxB
2	(not connected)	RxA
3	Data pair shield	Data pair shield
4	B	TxB
5	A	TxA

6. If you use RS-485 (or RS-422) to connect just one HMT330 to a master computer, enable the internal termination of HMT330 by switching switches 1 and 2 ON. Make sure that the master's end of the line is also terminated (by using master's internal termination or with a separate terminator).

   If you are connecting many transmitters to the same RS-485 bus, make sure that switches 1 and 2 are OFF and terminate the bus with separate terminators at both ends. This allows removing any transmitter without blocking the bus operation.

NOTE If you use the internal termination of the transmitter at the end of the RS-485 bus (instead of using separate terminators) removing that transmitter will block the bus operation.

7. Use the bus type (4-wire/2-wire) to select the selection switch 3.

   In 4-wire mode RS-485 master sends data to the HMT330 through terminals RxA and RxB and receives data from HMT330 through terminals TxA and TxB.

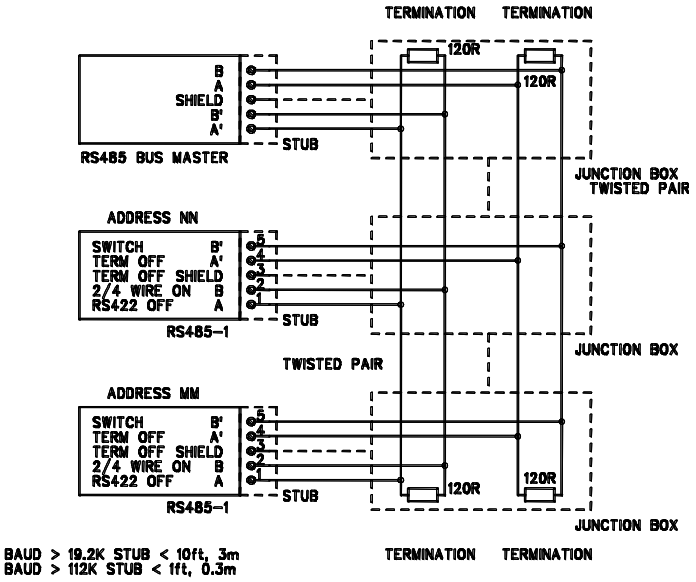


Figure 34 4-Wire RS-485 Bus

Table 6 4-Wire (Switch 3: On)

RS-485 master	Data	HMT330
TxA	→	RxA
TxB	→	RxB
RxA	←	TxA
RxB	←	TxB

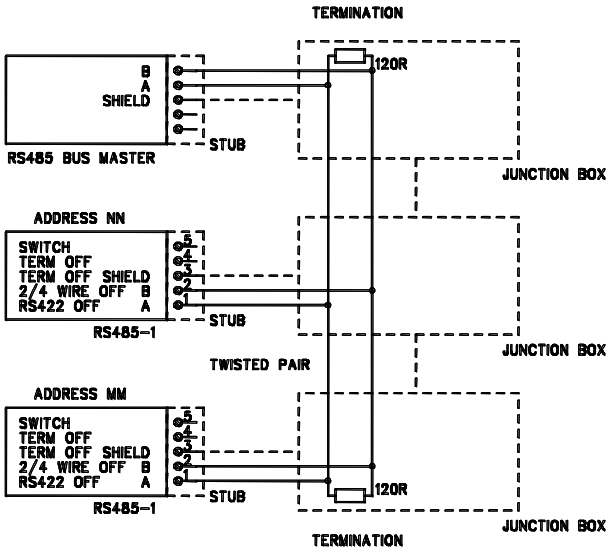


Table 7 2-Wire (Switch 3: Off)

RS-485 master	Data	HMT330
A	↔	A
B	↔	B

8. When operating in communication mode RS-422, set both switches 3 and 4 to ON position (4-wire wiring is required for RS-422 mode).
9. Connect the power and close the cover.

LAN Interface

The optional LAN interface enables an Ethernet connection to the transmitter. The LAN interface provides the same capabilities as the serial connection. The user can connect to the transmitter using the MI70 Link software, or by using a telnet client program such as Hyperterminal. When the LAN Interface is in use, serial communication using the User Port is disabled.

The LAN interface module must be installed at the factory (when ordering the transmitter), or by a Vaisala Service Center. Once installed, the module is automatically used by the transmitter. The physical connection to the network is made to the RJ45 connector on the LAN interface module, using a standard twisted pair Ethernet cable (10/100Base-T). Transmitters with the optional LAN interface are delivered pre-installed with a suitable cable and cable gland.

The LAN interface can use both static and dynamic network settings. If the interface is configured to use dynamic settings, the network where the LAN interface is connected must have a DHCP server that provides the settings.

The network configuration can be done using the optional display and keypad, or by using the service port. For instructions, see section LAN Communication on page 76. The LAN interface also provides a web configuration interface, which you can access by entering the IP address of the LAN interface in the address field of a web browser. For instructions on how to verify the current settings and status of the LAN interface, see section Device Information on page 101.

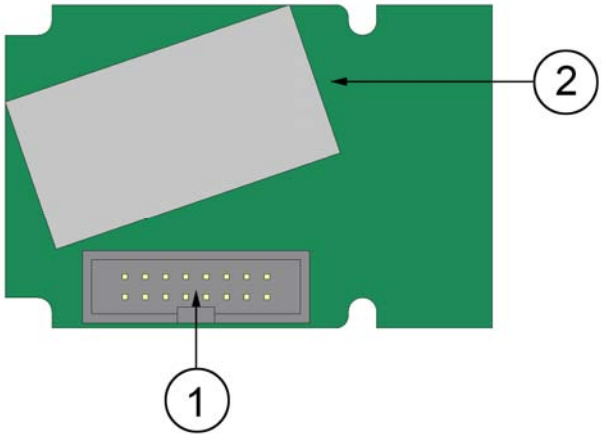


Figure 35 LAN Interface Module

The following numbers refer to Figure 35 above:

1 = Flat cable connector
2 = RJ45 connector with indicator LEDs for link and activity

WLAN Interface

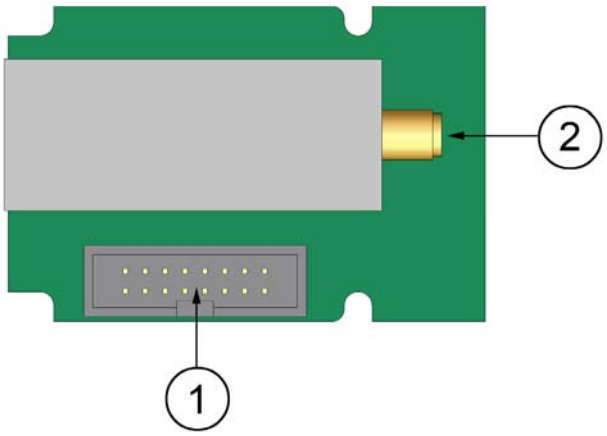
The optional WLAN interface enables a wireless Ethernet connection (IEEE 802.11b) to the transmitter. The interface supports Wired Equivalent Privacy (WEP) and Wi-Fi Protected Access (WPA). For WEP, 64 and 128 bit encryption is supported, with open system or shared key authentication. WPA is used in the Pre-Shared Key (PSK) mode, with either TKIP or CCMP protocol.

The WLAN interface provides the same capabilities as the serial connection. The user can connect to the transmitter using the MI70 Link software, or by using a telnet client program such as

Hyperterminal. When the WLAN Interface is in use, serial communication using the User Port is disabled.

Similarly to the LAN Interface, the WLAN interface can use both static and dynamic network settings. If the interface is configured to use dynamic settings, the network where the WLAN interface is connected must have a DHCP server that provides the settings.

The WLAN interface also provides a web configuration interface, which you can access by entering the IP address of the WLAN interface in the address field of a web browser.



0802-103

Figure 36 WLAN Interface Module

The following numbers refer to Figure 36 above:

1 = Flat cable connector
2 = Connector for antenna cable (connected to transmitter cover)

Attaching the WLAN Antenna

The LAN interface module must be installed at the factory (when ordering the transmitter), or by a Vaisala Service Center. Before taking the transmitter into use, the user must attach the antenna of the WLAN interface into the RP-SMA connector on the transmitter cover. The location of the antenna is shown in Figure 74 on page 161.

Data Logger Module

The optional data logger module extends the data storage for the measurement data. When the data logger is present, this storage is automatically used by the transmitter. The stored data can be browsed

using the optional display module, and accessed through the serial connections. See sections Graphic History on page 64 and Data Recording on page 105.

The data logger module contains non-volatile flash memory providing 4 years 5 months of storage for 3 parameters at a 10 second sampling interval. When the memory is full, the data recording will not stop. Instead, the oldest data is overwritten. For each parameter and observation period, the module stores the minimum and maximum values during the interval, as well a data trend value that is averaged from samples taken during the interval (see Table 8 on page 59).

Table 8 Observartion Periods and Resolution

Observation Period	Period for Trend/Max/Min Calculations (Resolution)
20 minutes	10 seconds
3 hours	90 seconds
1 day	12 minutes
10 days	2 hours
2 months	12 hours
1 year	3 days
4 years	12 days

The quantities that are logged are the same that have been selected for measurement using the display/keypad or the serial line. When taking the transmitter into use, verify that the desired quantities are selected. If you change the quantities later, the transmitter will start logging the new quantities, and stop logging the quantities that are no longer selected. Changing the quantities does not delete any measurement data that is already in memory.

The data logger module has a real time clock with a battery back-up. The clock has been set to the Coordinated Universal Time (UTC) at the factory, and its time cannot be set by the user. The data that is stored in the logger's memory is timestamped using the logger's clock.

When date and time are set on the transmitter, they are stored to the transmitter's memory as an offset from the time on the logger's clock. When browsing the stored data, the time offset is applied to the timestamps shown in the graphical history, and data outputted from the serial port. The timestamps in the data logger's memory remain as they were originally stored.

You can compensate for the clock drift (less than ±2 min/year) by setting the time on the transmitter. This updates the time offset used on the display and the serial port. You can set the time by using the keypad/display or the serial commands.

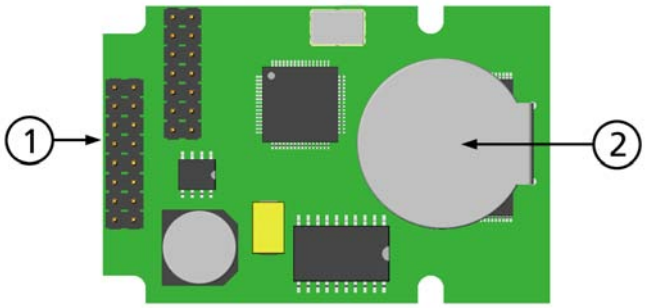


Figure 37 Data Logger Module

The following numbers refer to Figure 37 above:

1 = Flat cable pins
2 = Battery

After a reset or a power up, it will usually take at least 10 seconds before the data logger module is initialized. The real time clock and the data logging and reading functions are not available before the initialization is complete.

The indicator LED on the module will blink green during normal operation. If the LED is lit in red color, there is a problem with the module. The transmitter will also indicate the problem by activating the "Add-on module connection failure" error. If the module is not operating correctly, the transmitter must be sent to Vaisala for maintenance.

The data logger module must be installed at the factory (when ordering the transmitter), or by a Vaisala Service Center. Once installed, the module is automatically used by the transmitter. When the module requires a new battery, the transmitter must be sent to Vaisala for maintenance.

8-Pin Connector

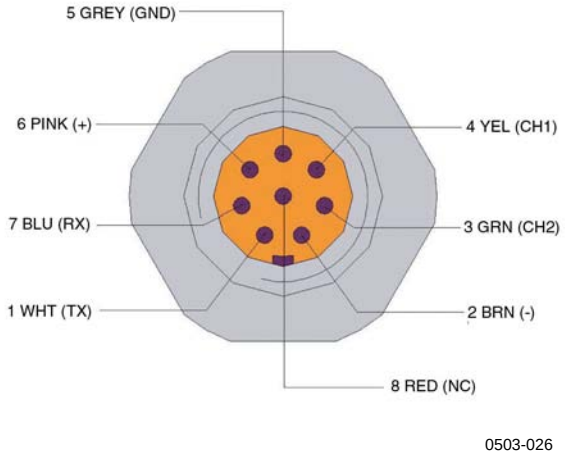


Figure 38 Wiring of Optional 8-Pin Connector

Table 9 Wiring of 8-Pin Connector

PIN/Terminal	Wire	Serial Signal		Analog Signal
		RS-232 (EIA-232)	RS-485 (EIA-485)	
1	White	Data out TX	A	-
2	Brown	(serial GND)	(serial GND)	Signal GND (for both channels)
3	Green	-	-	Ch 2+
4	Yellow	-	-	Ch 1 +
5	Grey	Supply -	Supply -	Supply -
6	Pink	Supply +	Supply +	Supply +
7	Blue	Data in RX	B	-
8	Shield/Red	Cable shield	Cable shield	Cable shield

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CHAPTER 4

OPERATION

This chapter contains information that is needed to operate this product.

Getting Started

Within a few seconds after power-up the LED on the cover of the transmitter is lit continuously indicating normal operation. When using the optional display and turning the transmitter on the first time, the language selection menu window opens. Select the language with ▼▲ arrow buttons and press the **SELECT** button (the left-hand button).

The pressure has an effect on humidity calculations and accuracy. Therefore, accurate calculations can be achieved only when the ambient pressure is taken into consideration. For instructions on how to set the pressure, see section Pressure Compensation Setting on page 95.

Display/Keypad (Optional)

Basic Display

Display shows you the measurement values of the selected quantities in the selected units. You can select 1 ... 3 quantities for the numerical basic display (see section Changing Quantities and Units on page 92.)

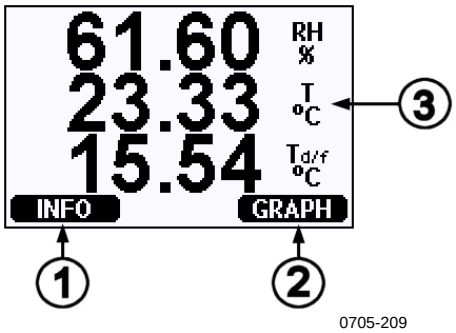


Figure 39 Basic Display

The following numbers refer to Figure 39 above:

1 = The Info shortcut button, see section Device Information on page 101
2 = The Graph shortcut button, see section Graphic History on page 64
3 = Quantities selected for display

NOTE	From any view, a four-second press on the right-hand function button takes you directly to the basic display.

Graphic History

The graphical display shows the data trend or min/max graph of the selected quantities, one at a time. The graph is updated automatically while measuring.

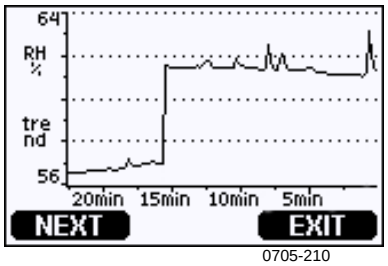


Figure 40 Graphical Display

Trend graph: Shows you a curve of average values. Each value is a calculated average over a period. See Table 10 on page 65 below.

Max/min graph: Shows you the minimum and maximum values in a form of curve. Each value is max/min over a time period. See Table 10 below.

Table 10 Periods for Trend and Max/Min Calculations

Observation Period	Period for Trend/Max/Min Calculations (Resolution)
20 minutes	10 seconds
3 hours	90 seconds
1 day	12 minutes
10 days	2 hours
2 months	12 hours
1 year	3 days
4 year*	12 days

* Shows the maximum logging period of the data logger module (available when data logger module is installed)

Use the following functions in the graphical display:

- Press the **NEXT** button to change between the trend graph and max/min graph for the quantities selected for display.
- Press the **EXIT** button to return to the basic display.
- Press the ▼▲ arrow buttons to zoom in and out in the graph window.
- Press the ◄► arrow buttons move the cursor (vertical bar) along the time axis. The cursor mode allows you to observe individual measuring points. The numerical value at the cursor position is shown at the left upper corner. The right upper corner shows the time from the present to the chosen moment (without the logger module), or the date and time at the cursor position (when the logger module is installed).
- If the optional data logger module is installed, you can scroll the cursor off the screen to move to a new point on the time axis. The new date will be displayed, and the cursor will be centered at the date where the cursor scrolled off the screen.

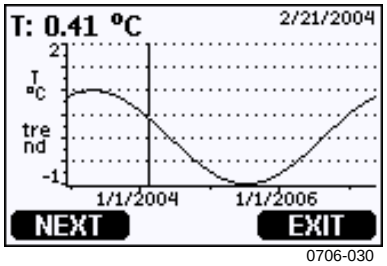


Figure 41 Graphical Display with Data Logger

The time that is shown below the graph is adjusted with the current time offset of the transmitter. If you change the transmitter's date and time setting, the displayed timestamps in the history graph change accordingly. For an explanation of the effect of changing the date and time manually, see section Data Logger Module on page 58.

Table 11 Graph Information Messages in Cursor Mode

Message	Interpretation
Power outage	Power failure (marked also with dashed vertical line)
No data	Quantity has not been selected for the display
Device failure	General device failure
T meas. failure	Temperature measurement/sensor failure
RH meas. failure	Humidity measurement/sensor failure
Adj. mode active	Adjustment mode active (data recorded in the adjustment mode is not displayed)

A question mark after time tells you that at least one power failure (dashed vertical line) has occurred after the chosen moment. In this case, the exact time difference between the present and the cursor position is not exactly known.

Menus and Navigation

You can change settings and select functions in the menus.

1. Open the **MAIN MENU** by pressing any of the ▼▲◄► arrow buttons in the basic (numeric) display mode.
2. Move in the menus by using the ▲▼ arrow buttons.
3. Open a submenu with ► button.
4. Press ◄ to return to the previous level.
5. Function button **EXIT** returns you back to the basic display.

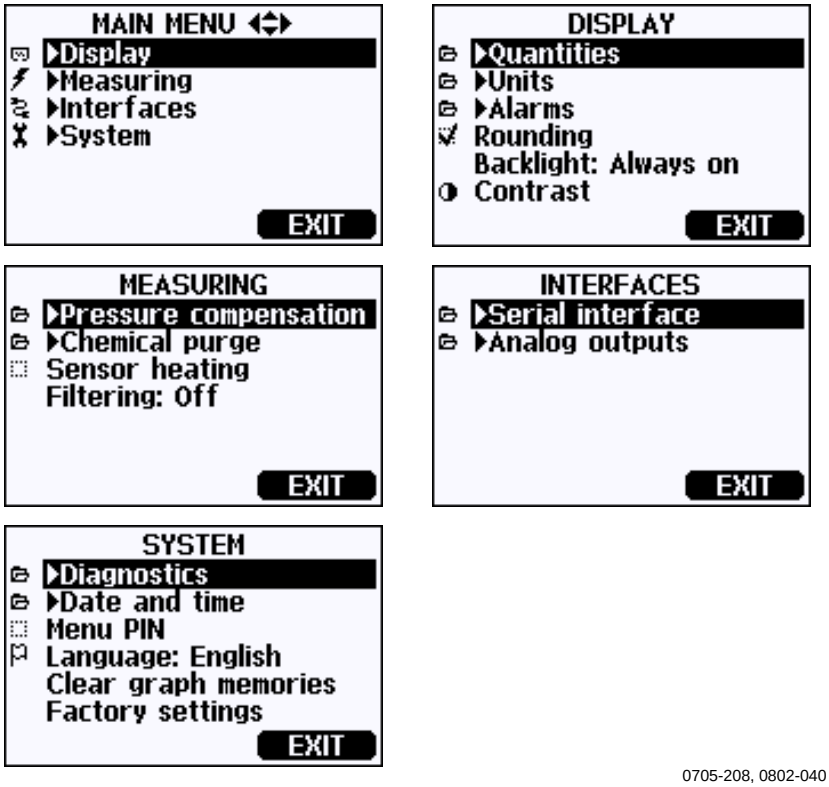


Figure 42 Main Menus

Some menu items, such as **Purge** in the **Measuring** menu, are only shown if supported by the transmitter and the installed options.

Changing the Language

1. Go back to the basic display by keeping the right-hand button pressed for four seconds.
2. Open the **Main menu** by pressing any of the ▼▲◄► buttons.
3. Scroll to the **System** menu option, and press the ► button. The menu option is indicated with the wrench symbol.
4. Scroll to the **Language** menu option, and the left-hand button. The menu option is indicated with the flag symbol.
5. Select the language with the ▼▲ buttons, and confirm the selection by pressing the left-hand button.
6. Press the right-hand button to exit to the basic display.

Rounding Setting

Round off one decimal by using the Rounding function. The default setting is rounding on. Rounding has no effect on quantities without decimals.

1. Open the **MAIN MENU** by pressing any of the ▼▲◄► arrow buttons.
2. Select **Display** and confirm by pressing the ►arrow button.
3. Select **Rounding** and press **ON/OFF** button.
4. Press **EXIT** to return to the basic display.

Display Backlight Setting

As a default the display backlight is always on. In the automatic mode the backlight stays on for 30 seconds from the last press of any button. When pressing any button, the light turns on again.

1. Open the **MAIN MENU** by pressing any of the ▼▲◄► arrow buttons.
2. Select **Display**, press the ►arrow button.
3. Select **Backlight**, press the **CHANGE** button.
4. Select **On/Off/Automatic**, press the **SELECT** button.
5. Press **EXIT** to return to the basic display.

Display Contrast Setting

1. Open the **MAIN MENU** by pressing any of the ▼▲◄► arrow buttons.
2. Select **Display**, press the ►arrow button.
3. Select **Contrast**, press the **ADJUST** button.
4. Adjust the contrast by pressing the ◄► arrow buttons.
5. Press **OK** and **EXIT** to return to the basic display.

Keypad Lock (Key guard)

This function locks the keypad and prevents unintentional key presses.

1. Keep pressing the left-hand function button for 4 seconds to lock the keypad (at any display).
2. To unlock the keypad, press the **OPEN** button for 4 seconds.

Menu PIN Lock

You can prevent unauthorized changes of the device settings by activating the menu PIN lock. When this function is activated, the basic display and graphical view are available but access to the menus is locked. The key symbol indicates the activation of this feature.

1. Open the **MAIN MENU** by pressing any of the ▼▲◄► arrow buttons.
2. Select **System**, press the ►arrow button.
3. Select **Menu PIN**, press the **ON** button.
4. Enter a PIN code by using the ▼▲arrow buttons. Press OK to confirm the setting. Now the PIN lock is on and a key symbol is shown in a display.
5. Press **EXIT** to return to the basic display. Returning to the menu is possible only by entering the correct PIN code.

When you want to turn off the PIN lock, go to the menu by giving the PIN code and select **System, Menu PIN,** press **OFF** button.

In case you have forgotten the PIN code, open the transmitter cover and press the **ADJ** button once. Wait for a few seconds and the adjustment menu opens. Select **Clear menu PIN**, press **CLEAR.**

NOTE You can also disable the keypad completely with serial command **LOCK**.

Factory Settings

Use the display/keypad to restore the factory settings. This operation does not affect the adjustments. Only settings available in the menus are restored.

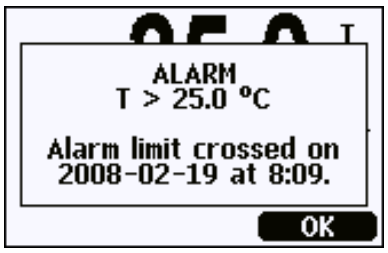
1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **System** by pressing the ► arrow button.
3. Select **Factory settings** and press the **REVERT** button to confirm your selection. Press the **YES** button to reset all settings to the factory defaults.

See section General Settings on page 92 for a description of the other menu options.

Display Alarms

The Display Alarm feature provides two independently configurable alarms for transmitters with the display/keypad option. Each alarm tracks a selected quantity, with a freely configurable low and high limit. Each alarm also has a configurable hysteresis value to prevent unnecessary triggering when the measurement fluctuates around an alarm limit. The alarms can be configured for any quantity supported by the transmitter. The configuration of the Display Alarms can only be done using the display/keypad option.

An alarm is activated when the selected quantity goes higher than the high limit, or lower than the low limit, much in the same way as the relays. When an alarm is activated, an alarm note is displayed on the display, and the lights of the display will blink.



0802-041

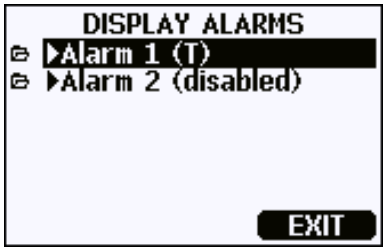
Figure 43 Display Alarm Active

Multiple alarms can be active at the same time; the alarm that was triggered first will be shown on the display. The next active alarm is revealed when the currently shown alarm is acknowledged by pressing the **OK** button.

Note that activated alarms are only shown on the screen. There are no alarm messages output to the serial line, or markers placed in the graph data. After an alarm has been acknowledged, you must refer to the data graphs to see when the measured quantities have exceeded the limits.

Configuring a Display Alarm

1. Enter the **Main Menu** by pressing an arrow key on the keypad.
2. Use the arrow keys to select **Display**, followed by **Alarms,** to open the **Display Alarms** menu. The Display Alarms menu shows the currently enabled and disabled alarms.



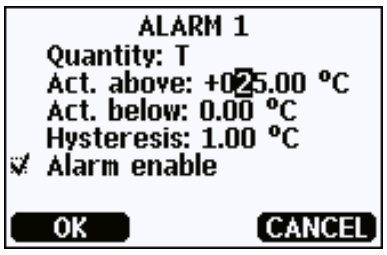
0802-069

Figure 44 Display Alarms

3. Use the arrow keys to select an alarm to configure. The alarm editing page opens.

NOTE	Changes you do on the alarm editing page will take effect immediately, and may cause an alarm to appear on the screen.

4. To select a quantity for the alarm, press the **Change** button and select the quantity from the list.
5. To modify or remove the alarm limit values, move the selection over the **Act. above** or **Act. below** field and press the **Set** button. You will be prompted to **Modify** or **Remove** the value.



0802-070

Figure 45 Modifying an Alarm Limit

When modifying the value, use the arrow up and down buttons to change the value under the cursor. Left and right arrow buttons move the cursor. Select the OK button to accept the modified value, or Cancel to undo the modification.

6. Set a suitable **Hysteresis** value to prevent the alarm from being triggered unnecessarily by small measurement changes that pass the alarm limit repeatedly.
7. Set or clear the **Alarm enable** checkbox to enable or disable the alarm.
8. Press the **Exit** button to leave the alarm configuration screen and return to the basic view.

MI70 Link Program for Data Handling

The recorded data can be transferred to a PC by using MI70 Link program. You can examine the recorded data easily in Windows environment and transfer it further to a spreadsheet program (such as Microsoft Excel) or virtually to any Windows program in numeric or graphical format. MI70 Link program allows you also to monitor transmitter readings directly with a PC (real-time window function).

Use a MI70 Link version 1.2, or a newer one, to be able to utilize all the functions of HMT330.

1. Connect your PC to the transmitter using the serial interface, LAN interface, or the WLAN interface. Refer to sections Serial Line Communication on page 72, and LAN Communication on page 76.
2. Check that the HMT330 is powered.
3. Start the MI70 Link program.
4. If you are connecting through the LAN or WLAN interface, you must enter the IP address of the transmitter. You can check the IP address using the device information display; see section Device Information on page 101. If you do not have the display/keypad option, you can use the NET command on the serial line; see section IP Configuration on page 76.

   If you are connecting through the serial interface, the program detects the connection type automatically; there is usually no need to select a COM port manually.

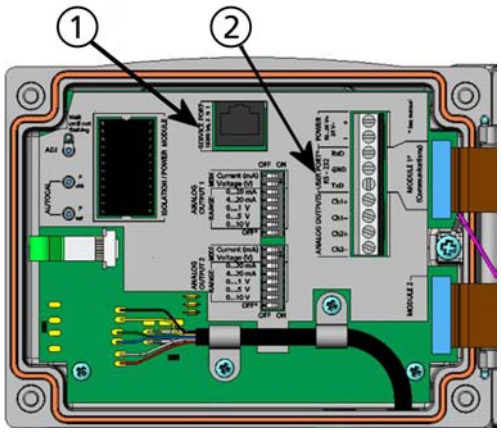
The MI70 Link program, and the optional connection cables, are available from Vaisala. See list of accessories in section Options and Accessories on page 158.

Serial Line Communication

Connect the serial interface by using either the user port or the service port.

For permanent interfacing to host system, use the user port. You can change the serial settings and operate in RUN, STOP and POLL modes.

For temporary connections, use the service port. The service port is always available with fixed serial settings.



0605-039

Figure 46 Service Port Connector and User Port Terminal on Mother Board

The following numbers refer to Figure 46 above:

1 = Service port connector
2 = User port terminals

User Port Connection

Use a suitable serial cable between the user port RxD, GND and TxD screw terminals and the PC serial port, see Figure 47 on page 74.

Table 12 Default Serial Communication Settings for the User Port

Parameter	Value
Bauds	4800
Parity	Even
Data bits	7
Stop bits	1
Flow control	None

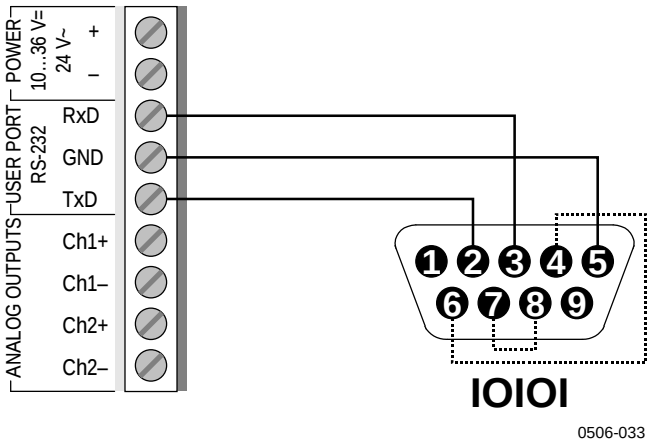


Figure 47 Connection Example Between PC Serial Port and User Port

Connections to pins 4, 6, 7 and 8 on PC serial port are required only if you are using software requiring hardware handshaking.

After power-up the transmitter (in STOP-mode) outputs the software version and the command prompt.

```
HMT330/5.00
>
```

In RUN mode a measurement output starts immediately after power-up.

In POLL mode, the transmitter does not output anything after power-up (see section SMODE on page 123).

NOTE User port cannot be used when the RS-485 module is connected.

Service Port Connection

Connection Cables

To connect to the service port, you need a suitable cable with an RJ45 connector. Depending on the connections of your PC, you can either use the Serial Connection Cable (optional accessory 19446ZZ) or the USB-RJ45 Serial Connection Cable (optional accessory 219685). The USB cable enables you to connect the transmitter to a PC via a standard type A USB port. Note that the USB cable does not enable high speed data transfer, since the bit rate is limited by the serial interface of the service port.

Installing the Driver for the USB Cable

Before taking the USB cable into use, you must install the provided USB driver on your PC. When installing the driver, you must acknowledge any security prompts that may appear. The driver is compatible with Windows 2000, Windows XP, Windows Server 2003, and Windows Vista.

1. Check that the USB cable is not connected. Disconnect the cable if you have already connected it.
2. Insert the media that came with the cable, or download the driver from www.vaisala.com.
3. Execute the USB driver installation program (setup.exe), and accept the installation defaults. The installation of the driver may take several minutes.
4. After the driver has been installed, connect the USB cable to a USB port on your PC. Windows will detect the new device, and use the driver automatically.
5. The installation has reserved a COM port for the cable. Verify the port number, and the status of the cable, using the **Vaisala USB Instrument Finder** program that has been installed in the Windows Start menu.

Windows will recognize each individual cable as a different device, and reserve a new COM port. Remember to use the correct port in the settings of your terminal program. If you are using the Vaisala MI70 Link application, you do not need to check the COM port, as the MI70 Link detects the USB connection automatically.

There is no reason to uninstall the driver for normal use. However, if you wish to remove the driver files and all Vaisala USB cable devices, you can do so by uninstalling the entry for **Vaisala USB Instrument Driver** from the **Add or Remove Programs** (**Programs and Features** in Windows Vista) in the Windows Control Panel.

Using the Service Port

1. Unfasten the screws on the transmitter cover, and open the transmitter.
2. Connect the desired cable (serial interface cable or USB cable) to your PC and the service port connector on the transmitter. For the location of the service port, refer to Figure 46 on page 73.
3. Open a terminal program and set the communication settings as follows:

Table 13 Communication Settings for the Service Port

Parameter	Value
Bauds	19200
Parity	None
Data bits	8
Stop bits	1
Flow control	None

For a detailed explanation of using a terminal program, see section Terminal Program Settings on page 78.

4. Power-up the HMT330.

LAN Communication

To enable LAN communication, a LAN or WLAN interface must be physically connected to the network, and the networking settings must be suitable for your network. For a description of interfaces, see sections LAN Interface on page 56 and WLAN Interface on page 57.

The LAN and WLAN interfaces both operate by accessing the serial interface (User Port) of the transmitter. All commands that are available using the serial interface are available through the LAN and WLAN interfaces; refer to section List of Serial Commands on page 87. For instructions on how to connect using a terminal program, see section Terminal Program Settings on page 78.

IP Configuration

The IP settings of the LAN and WLAN interfaces are described in Table 14. The current settings can be viewed on the serial line or using the device information display; see section Device Information on page 101.

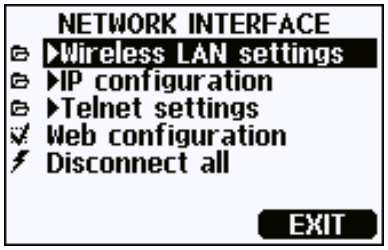
Table 14 IP Settings for the LAN and WLAN Interfaces

Parameter	Description
Automatic configuration (DHCP)	If enabled, the transmitter will retrieve its network settings (including the IP Address) from a server in the network. If disabled, static network settings are used instead.
Web configuration	If enabled, the settings of the interface can be changed using a web browser. The configuration page can be accessed by browsing to the IP address of the transmitter.
IP Address	The four part network ID of the transmitter. Must be set manually if automatic configuration is not used. Example value: **192.168.0.222**
Netmask	Used together with the IP address to determine which network the transmitter is a part of. Must be set manually if automatic configuration is not used. A common netmask is **255.255.255.0**.
Gateway	IP address of the server that enables the transmitter to access other networks. Must be set manually if automatic configuration is not used. Example value: **192.168.0.1**
MAC	The MAC address is the unique hardware address of the LAN or WLAN interface. Cannot be changed.

Using Display/Keypad

You can configure the IP settings of the LAN and WLAN interfaces using the display/keypad as follows:

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Press the ► arrow button to select **Interfaces**.
3. Press ► arrow button to select **Network settings**. There will be a delay as the transmitter refreshes the network information.
4. You are now in the **Network Interface** menu. Selecting the **IP configuration** option opens the IP configuration menu.



0802-113

Figure 48 Network Interface Menu

The **Network Interface** menu also allows you to enable or disable the **Web configuration** option, or **Disconnect all** users that are currently accessing the LAN or WLAN interface.

5. In the IP configuration menu, select **Automatic configuration (DHCP)**, or enter the **IP address**, **Netmask** and **Gateway** manually. If automatic configuration is enabled, manual configuration cannot be done.

0709-004

Figure 49 IP Configuration Menu

To enter a value manually, use the the ▲▼ arrow buttons to select the parameter to change, and press **Change**. A cursor will appear in the first digit. Move the cursor using the ◄► arrow buttons, and change the value under the cursor using the ▲▼ arrow buttons. Confirm the selection by pressing **OK**.

6. After configuring the desired parameters, press **EXIT** to return to the basic display.

Using Serial Line

Use the serial line command **NET** to view or set the network settings for the LAN and WLAN interfaces. You can also refresh the network information or disconnect all active connections.

NET [*REFRESH*] [*DISCONNECT*] [*DHCP WEB*] [*DHCP IP SUBNET GATEWAY WEB*]

where

REFRESH	=	Updates the network information and displays it
DISCONNECT	=	Disconnects all current sessions
DHCP	=	ON or OFF. Enables or disables the automatic IP configuration.
WEB	=	ON or OFF. Enables or disables the Web Configuration page.
IP	=	The four part network ID of the transmitter. Must be set manually if automatic configuration is not used.
SUBNET	=	Used together with the IP address to determine which network the transmitter is a part of. Must be set manually if automatic configuration is not used.
GATEWAY	=	IP address of the server that enables the transmitter to access other networks. Must be set manually if automatic configuration is not used.

Examples:

```
>net refresh
OK
DHCP           : OFF
IP address     : 192.168.0.101
Subnet mask    : 255.255.255.0
Default gateway: 192.168.0.1
Web config.    : OFF
MAC address    : 00:40:9d:2c:d2:05
Telnet         : Not connected
>

>net on off
DHCP           : ON
IP address     : 192.168.0.104
Subnet mask    : 255.255.255.0
Default gateway: 192.168.0.1
Web config.    : OFF
MAC address    : 00:40:9d:2c:d2:05
Telnet         : Connected
OK
>
```

```
>net off 192.168.0.101 255.255.255.0 192.168.0.1 off
DHCP           : OFF
IP address     : 192.168.0.101
Subnet mask    : 255.255.255.0
Default gateway: 192.168.0.1
Web config.    : OFF
MAC address    : 00:40:9d:2c:d2:05
Telnet         : Connected
OK
>
```

Wireless LAN Configuration

The settings of the WLAN interface are described in Table 15. The current settings can be viewed on the serial line or using the device information display; see section Device Information on page 101.

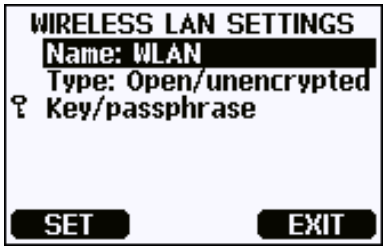
Table 15 Wireless LAN Settings

Parameter	Description
SSID	The service set identifier (i.e. network name) of the wireless network to connect to. 1 … 32 characters.
Security type	The security type of the wireless network. The options are: OPEN OPEN/WEP WPA-PSK/TKIP WPA-PSK/CCMP All other choices except OPEN require a security key; see below.
Security key	The encryption key or passphrase that is used with an encrypted network.

Using Display/Keypad

You can configure the Wireless LAN settings using the display/keypad as follows:

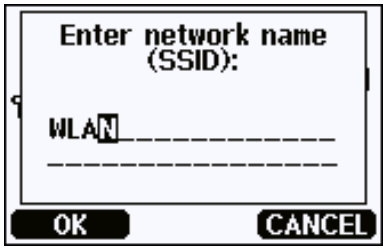
1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Press the ► arrow button to select **Interfaces**.
3. Press the ► arrow button to select **Network settings**. There will be a delay as the transmitter refreshes the network information.
4. Press the ► arrow button to select **Wireless LAN settings**.



0802-111

Figure 50 Wireless LAN Settings

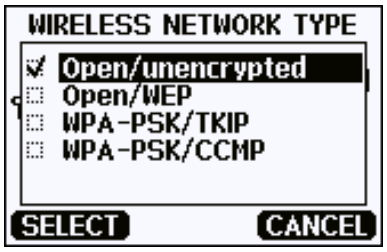
5. The **Name** entry on the page shows the SSID of the currently selected wireless network. To change the SSID, press the **SET** button. Use the ▲▼ arrow buttons to change the character under the cursor, and ◄► arrow buttons to more the cursor. Press the **OK** button when done.



0802-110

Figure 51 Entering Network SSID

6. To change the currently selected Network type, select the **Type** entry and press the **Change** button. Select the new type from the list and press the **Select** button.



0802-112

Figure 52 Selecting the Wireless Network Type

7. If you have selected an encrypted network type (WEP or WPA), you must enter the security key to be used. Select the **Key/passphrase** entry and press the **Set** button. Enter the key in the same way as the SSID, and press the **OK** button. With the WEP encryption you must enter the encryption key in hexadecimal (10 hexdecimals for 64-bit encryption or 26 hexadecimals for 128-bit encryption). A WPA key must be 8 … 63 ASCII characters.

8. After setting the wireless network parameters, press the **Exit** button in the **Wireless Network Settings** menu. You will be asked to confirm the new settings. Note that when new settings are saved, all currently active WLAN connections are disconnected.

Using Serial Line

Use the serial line command **WLAN** to view or set the wireless network settings. If you set an encrypted network type, you will be asked to enter the security key. With the WEP encryption you must enter the encryption key in hexadecimal (10 hexdecimals for 64-bit encryption or 26 hexadecimals for 128-bit encryption) or with plain ASCII characters (5 characters for 64-bit encryption or 13 characters for 128-bit encryption). A WPA key must be 8 … 63 ASCII characters.

WLAN [*SSID TYPE*]

Where

SSID	=	The network name in 1 … 32 characters
TYPE	=	The security type of the wireless network. The options are: OPEN OPEN/WEP WPA-PSK/TKIP WPA-PSK/CCMP

Examples:

```
>wlan ?
Network SSID   : WLAN-AP
Type           : OPEN
>

>wlan accesspoint wpa-psk/tkip
Network SSID   : accesspoint
Type           : WPA-PSK/TKIP
WPA-PSK phrase ? thequickbrownfox
Warning: Active connection will be disconnected.
Save changes (Y/N) ? y
OK
>
```

Telnet Settings

When a telnet connection is established via the LAN or WLAN interface, the session has the same communication mode, run interval, poll address and echo settings as the serial port (user port) session would have.

These settings can be changed using the display/keypad, using the serial line (user port or service port), or on-the-fly during the telnet session.

The display menu path to the telnet settings is:
Main menu ► Interfaces ► Network Interface ► Telnet settings.

The commands for changing the settings are **SMODE**, **INTV**, **ADDR**, and **ECHO**.

Web Configuration for LAN and WLAN

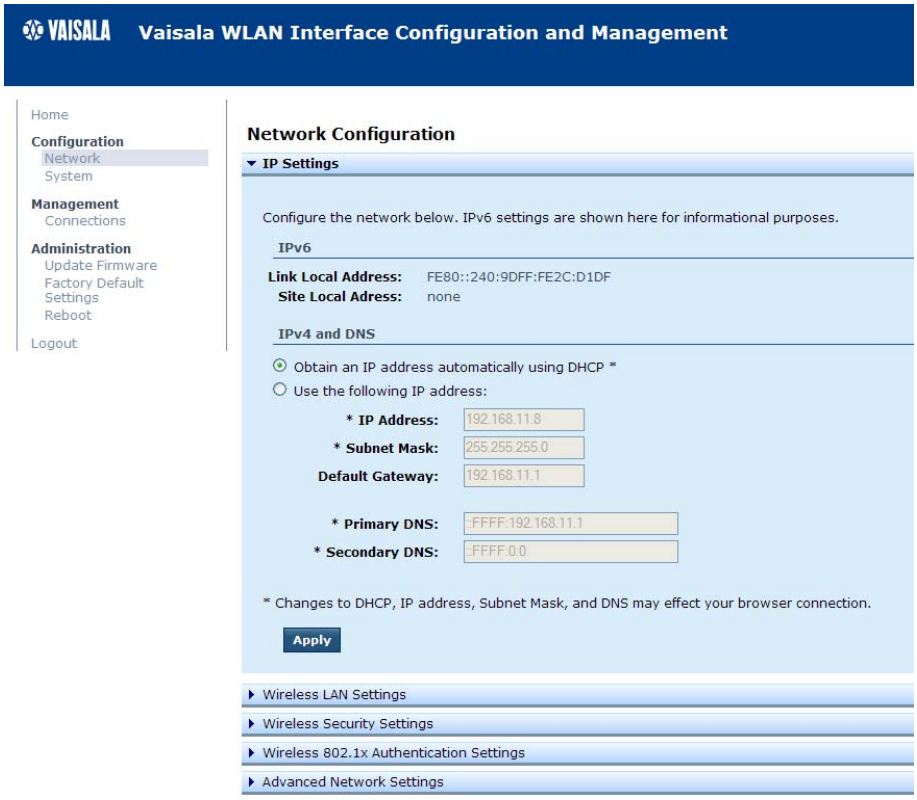
The LAN and WLAN interfaces both have a web configuration page that is accessible using a browser. If you have not disabled the page from the network settings, you can access it with a web browser at the IP address of the interface.

When accessing the web configuration page, you must first log in.

Username: **user**
Password: **vaisala**

The web configuration page provides similar network configuration options as the serial line and the display/keypad. It also has additional options for advanced users. For example, there are more options for securing the wireless network.

If these additional options are used, they will appear as custom configurations when viewed from the serial line or the display/keypad.



0802-114

Figure 53 Web Configuration Interface for WLAN

Terminal Program Settings

The following instructions show a connection example with HyperTerminal program for the Microsoft Windows® operating system.

NOTE	HyperTerminal is not included with the Windows Vista operating system.

1. Start HyperTerminal. To get help for starting HyperTerminal, click **Start**, select **Help** to open Windows help, and search for "HyperTerminal".
2. In the **New Connection** window of the HyperTerminal, define a name for HMT330 serial connection, for example "Vaisala Transmitter". Click **OK**.

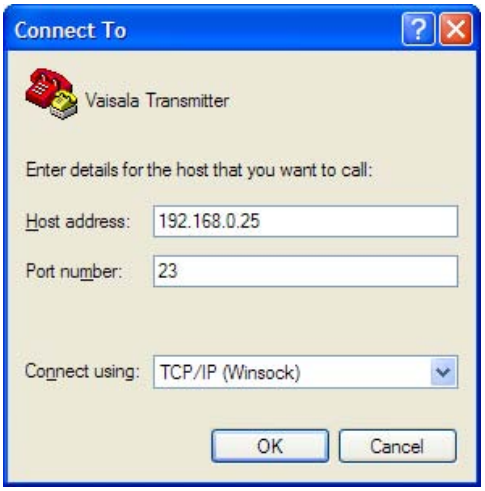
3. Select the connection type using the **Connect using** pull down menu.

   If you are connecting to the transmitter using the serial interface, select the PC communications port where the serial cable is connected and click **OK**. If you are using the USB-RJ45 cable to connect to the Service Port, check the communications port that the cable is using with the **USB Instrument Finder** program that has been installed in the Windows Start menu.

0709-005

Figure 54 Connecting Using Serial Interface

If you are connecting using the LAN or WLAN interface, select **TCP/IP (Winsock)**. Enter the IP address of the interface in the **Host address** field, and 23 as the **Port number**. Click **OK** to connect to the transmitter.



0709-007

Figure 55 Connecting Using a Network

4. If you selected a serial port, you must match the port settings in the **Properties** window with the transmitter's serial interface (user port or service port). If you are using the USB-RJ45 cable, you are connecting to the service port. Verify that **Flow control** is set to **None**. Click **OK** to start using the serial connection.

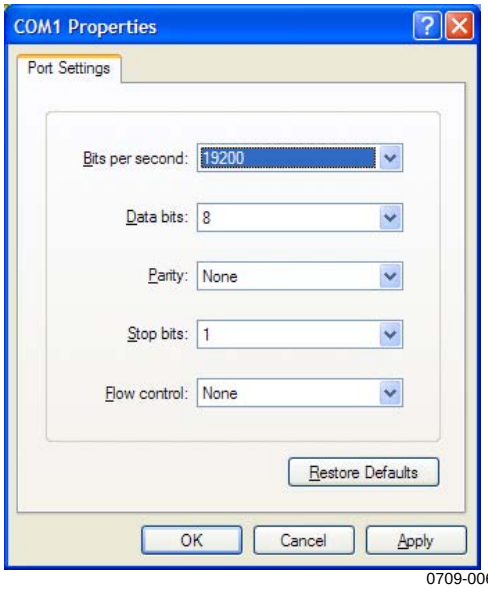


Figure 56 Hyper Terminal Serial Port Settings

5. Select **File → Save** in the HyperTerminal main window to save the connection settings. To use the saved settings later, start HyperTerminal, click cancel in the **New Connection** window, and select **File → Open**.

List of Serial Commands

The **bold** text in the brackets is the default setting. To issue a command, type it on your computer and press the Enter key.

Table 16 Measurement Commands

Command	Description
R	Start the continuous outputting
S	Stop the continuous outputting
INTV [**0** ... 255 **S**/MIN/H]	Set the continuous output interval (for RUN mode)
SEND [0 ... 99]	Output the reading once
SEND D	Outputting the reading with the raw data
SMODE **[STOP**/RUN/POLL]	Set the serial interface mode
SDELAY	View or set user port (RS232 or RS485) answer minimum delay
SERI [baud p d s]	User Port settings (Default: 4800 E 7 1) baud: 300 ... 115200
ADDR **[0** ... 99]	Set the transmitter address (for POLL mode)
NET	View or set networking parameters for LAN and WLAN interfaces
WLAN	View or set wireless network parameters for WLAN interface
OPEN **[0** ... 99]	Open a temporary connection to a POLL mode device
CLOSE	Close the temporary connection (Back to POLL mode)

Table 17 Formatting Commands

Command	Description
FORM	Set the output format of SEND and R commands
TIME	Set the time
DATE	Set the date
FTIME [ON/**OFF**]	Add time to SEND and R outputs
FDATE [ON/**OFF**]	Add date to SEND and R outputs
FST [ON/**OFF**]	Add the state of probe heating and chemical purge in connection with SEND and R commands
UNIT	Select the metric or non-metric output units

Table 18 Data Recording Commands

Command	Description
DIR	Display recorded files
PLAY [0 ... 21] [START END]	Output recorded data file. Start and end times can only be specified if the data logger module is installed. The times must be given in the following format:

Command	Description
	yyyy-mm-dd hh:mm:ss
DSEL	Select data recording and display quantities.
DELETE	Delete all data files, including the memory of the optional data logger module
UNDELETE	Recover the deleted files that have not been overwritten

Table 19 Chemical Purge Commands

Command	Description
PUR	Set the automatic chemical purge
PURGE	Start the manual chemical purge

Table 20 Calibration and Adjustment Commands

Command	Description
CRH	Relative humidity calibration
CT	Temperature calibration
CTA	Additional temperature probe calibration
FCRH	Relative humidity calibration after sensor change
CTEXT	Give the text to calibration information field
CDATE	Set the calibration date
ACAL	Analog output calibration

Table 21 Setting and Testing the Analog Outputs

Command	Description
AMODE	View the analog output modes
ASEL	Select the parameters for the analog outputs
ITEST	Test the analog outputs
AERR	Change the analog error output values

Table 22 Setting and Testing the Relays

Command	Description
RSEL	Set and view the relays
RTEST	Test the relays

Table 23 Other Commands

Command	Description
?	Output information about the device
??	Output information about the device in POLL mode
ECHO [**ON**/OFF]	Turn the serial interface echo ON/OFF
ERRS	List present transmitter errors
FILT	Set the result filtering
FIND	All devices in POLL mode send their addresses
HELP	List the most common commands
LOCK	Lock the menu and disable the keypad
PRES [hPa]	Set the value for pressure compensations
VERS	Display the software version information
XHEAT	Sensor heating
XPRES [hPa]	Set the value for pressure compensations, temporarily

Getting Measurement Message from Serial Line

Starting Continuous Outputting

R

Enter the **R** command to start the continuous output of measurements.

Example:

```
>r
RH= 60.5 %RH T= 23.7 'C Tdf= 15.6 'C Td= 15.6 'C a= 13.0
g/m3   x=  11.1 g/kg  Tw= 18.5 'C H2O= 17889 ppmV pw=
17.81 hPa pws=  29.43 hPa h=  52.3 kJ/kg  dT=  8.1 'C
```

If a value is too long to fit to the allocated space in the output, or if there is an error in outputting the quantity, the value is displayed with stars ‘*’.

Example:

```
RH=***.* %RH T= 31.0 'C
```

You can change the format of the output with the following commands:

- Outputting interval can be changed with the **INTV** command.
- Output message format can be changed with the **FORM** command**.**
- Status of chemical purge and probe heating can be added with the **FST** command.
- Date and time information can be added with commands **FDATE** and **FTIME**

Stopping Continuous Outputting

S

Use the **S** command to end the RUN mode. After this command all other commands can be used. You can also press the Esc button or reset the transmitter to stop the outputting.

See command **SMODE** to change the default (power-up) operation mode.

Outputting Reading Once

SEND

Use the SEND command to output the reading once in STOP mode. The output format depends on which parameters the transmitter can output.

Examples:

```
RH= 98.4 %RH T= 31.1 'C

RH= 98.4 %RH T= 31.1 'C Td= 36.0 'C Tdf= 36.0 'C a= 42.4
g/m3   x=  38.8 g/kg  Tw= 30.8 'C ppm= 62414 pw=  59.53
hPa pws=  60.52 hPa h= 130.7 kJ/kg
```

Outputting Reading with Raw Data

SEND D

Example:

```
>send d
 24.1720  15.0399  -3.5743 189.2324  15.0709  15.0399
23.9765
```

Where the readings (from the left) are:

24.1720 = Temperature of the humidity probe (ºC)
15.0399 = RH (%RH)
-3.5743 = Tdf (C)
189.2324 = Capacitance (pF)
15.0709 = RH raw: calculated from scaled capacitance (%RH)
15.0399 = Enhancement factor corrected RH (%RH)
23.9765 = Temperature of the additional temperature probe (optional) (ºC)

Formatting Serial Line Message

FTIME and FDATE

FTIME and **FDATE** commands will enable/disable output of time and date to the serial line. To add time to R and SEND outputs enter:

FTIME [*x*]

To add date to **R** and **SEND** outputs enter:

FDATE [*x*]

where

x = ON or OFF

Example:

```
>send
RH= 98.4 %RH T= 31.0 'C
>ftime on
Form. time     : ON
>send
03:47:59 RH= 98.4 %RH T= 31.0 'C
>fdate on
Form. date     : ON
>send
2004-07-05 03:48:03 RH= 98.4 %RH T= 31.0 'C
>
```

FST

To output the state of optional probe heating and chemical purge in connection with SEND and R commands enter:

FST [*x*]

Where

x = ON or OFF (default)

Example:

```
>fst on
Form. status   : ON
>send
N    0 RH= 40.1 %RH T= 24.0 'C Td=  9.7 'C Tdf=  9.7 'C
a=  8.7 g/m3   x=   7.5
g/kg  Tw= 15.6 'C ppm= 11980 pw=  12.00 hPa pws=  29.91
hPa h=  43.2 kJ/kg
>purge
Purge started, press any key to abort.
>send
S  134 RH= 40.2 %RH T= 24.1 'C Td=  9.8 'C Tdf=  9.8 'C
a=  8.8 g/m3   x=   7.5
g/kg  Tw= 15.7 'C ppm= 12084 pw=  12.10 hPa pws=  30.11
hPa h=  43.5 kJ/kg
>
```

For more information on chemical purge, see section Chemical Purge (Optional) on page 126.

Where the state of the probe is indicated by the following letters and values:

N ... xxx	=	Normal operation	where h xxx	=	Probe heat power
X ... xxx	=	Sensor heating	where xxx	=	Sensor temperature (ºC)
H ... xxx	=	Chemical purge	where xxx	=	Sensor temperature (ºC)
S ... xxx	=	Sensor cooling after purge	where xxx	=	Sensor temperature (ºC)

General Settings

Changing Quantities and Units

To change quantities and units use serial commands or the optional display/keypad. See Table 2 on page 17 for available quantities and Table 3 on page 18 for optional quantities.

NOTE	Only the quantities selected when ordering the device can be selected as a display output quantity.

Using Display/Keypad

Use display/keypad to select the display output quantities.

1. Press any of the arrow buttons to open the **MAIN MENU**.

2. Press the ► arrow button to select **Display**.
3. Press ► arrow button to select **Quantities**.
4. Select the quantity by using the ▲▼ arrow buttons. Confirm the selection by pressing **SELECT**. You can select 1 ... 3 display quantities at a time.
5. Press **EXIT** to return to the basic display.

To select display units:

1. Press any of the arrow buttons to open the MAIN MENU.
2. Press the ► arrow button to select **Display**.
3. Use the ▲▼arrow buttons to select **Units**. Confirm the selection by pressing the right-hand arrow button.
4. Use the ▲▼ arrow buttons to select display units. Confirm the selection by pressing **CHANGE**. The unit changes from metric to non-metric or the other way round.
5. Press **EXIT** to return to the basic display.

NOTE	Changing the display quantities/units (by using the display/keypad) has no effect on the serial output data.

Using Serial Line

Use the serial line command **FORM** to change the format or select a certain quantities for the output commands **SEND** and **R**. Use the serial line command UNIT to select metric or non-metric output units.

FORM

Use the serial line command **FORM** to change the format or select a certain quantities for the output commands **SEND** and **R**.

FORM [*x*]

where

x = Formatter string

Formatter string consists of quantities and modifiers.

When entering the command, use the abbreviations of the quantities. For more information on quantities, see Table 2 and Table 3 on page 17.

The modifiers are presented in Table 24 below.

Table 24 FORM Command Modifiers

Modifier	Description
x.y	Length modifier (number of digits and decimal places)
#t	Tabulator
#r	Carriage-return
#n	Line feed
“”	String constant
#xxx	Special character, code "xxx" (decimal), for example #027 for ESC
U5	Unit field and length
ADDR	Transmitter address with two characters [00...99]
ERR	Error flags for P, T, Ta, RH [0000 ... 1111], 0 = no error
STAT	Transmitter status in 7 character field, for example: N 0 no heating h 115 probe heating active, power 115/255 H 159.0 purge heating active, temperature 159ºC S 115.0 purge cooling active, temperature 115ºC X 95.0 sensor heating active, temperature 95ºC
SN	Transmitter serial number
TIME	Time [hh:mm:ss]
DATE	Date [yyyy-mm-dd]
OK	Pressure stability indicator, two characters [OK or " "]
CS2	Modulus-256 checksum of message sent so far, ascii encoded hexadecimal notation
CS4	Modulus-65536 checksum of message sent so far, ascii encoded hexadecimal notation
CSX	NMEA xor-checksum of message sent so far, ascii encoded hexadecimal notation
A3H	Pressure tendency [* or 0...8]

Example:

```
>form "RH=" 4.2 rh U5 #t "T=" t U3 #r #n
RH=  14.98%RH   T=  74.68'F

>send
RH=  16.03%RH   T=  74.66'F

>form "Tfrost=" tdf U3 #t "Temp=" t U3 #r#n
Tfrost=   36.0'C        Temp=   31.0'C
>
```

Command ‘**FORM /**’ will return the default output format. The default output format depends on the device configuration.

```
>form /
>send
RH= 98.4 %RH T= 31.1 'C
>
```

UNIT

Use the **UNIT** command to select metric or non-metric output units:

UNIT [*x*]

where

x = M or N

where

M = Metric units
N = Non-metric units

NOTE	This command changes both the serial output and display units to either metric or non-metric units. When you want to output both metric and non-metric units simultaneously on the display, select the display units later by using the display/keypad.

Pressure Compensation Setting

The pressure has an effect on humidity calculations and accuracy. Therefore, accurate calculations can be achieved only when the process pressure is taken into consideration.

Note that conversions from mmHg and inHg are defined at 0°C and for mmH_2O and inH_2O at 4°C.

NOTE	Pressure compensation is intended to be used in normal air only. When measuring in other gases, please contact Vaisala for further information.

Using Display/Keypad

Use display/keypad to set the pressure compensation. To select the pressure unit using display/keypad, see section Changing Quantities and Units on page 92.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select **Measuring** and press the ►arrow button to confirm your selection.
3. Select Pressure compensation and press the ►arrow button to confirm you selection.
4. Press **SET** and enter the pressure value in the chosen unit by using the arrow buttons.
5. Press **OK** and **EXIT** to return to the basic display.

Using Serial Line

PRES and XPRES

Command **XPRES** should be used if the value is changed frequently. Its value is not retained at reset, and when set to 0; last value set with **PRES** is used instead. Use the serial line and do the following:

PRES [*aaaa.a*]

XPRES [*aaaa.a*]

where

aaaa.a =Absolute process pressure (hPa)

Example:

```
>pres
Pressure       : 1013.00 hPa ?
>pres 2000
Pressure       : 2000.00 hPa
>
```

Table 25 Multiplication Factors

From	To: hPa
mbar	1
Pa N/m2	0.01
mmHg torr	1.333224
inHg	33.86388
mmH_2O	0.09806650
inH_2O	2.490889
atm	1013.25
at	980.665
bar	1000
psia [1)]	68.94757

1) psia = psi absolute.

Example:

29.9213 inHg = 29.9213 × 33.86388 = 1013.25 hPa

Date and Time

Using Display/Keypad

If the optional Data Logger Module is installed, you can change the time and date using the display/keypad.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select **System** and press the ►arrow button to confirm your selection.
3. Select **Date and time** and press the ►arrow button.
4. Press the **SET** button to enter the adjustment mode, and use the arrow buttons to select and change the values.
5. You can also change the date and time formats that are shown in the graphs. The selected formats are only used in graphical display, they do not change the formats that are used in the serial communication.
6. Press **EXIT** to return to the basic display.

Using Serial Line

To set time enter the **TIME** command. To set date enter the **DATE** command.

TIME

DATE

These time and date settings are shown on the timestamps of **PLAY** command. When you want to include time and date in the **R** and **SEND** commands, use the **FTIME** and **FDATE** commands.

Example:

```
>TIME
Time           : 13:42:49 ?

>DATE
Date           : 2007-05-31 ?
```

NOTE	If the optional Data Logger Module is not installed, time and date are cleared to 2000-01-01 00:00:00 at reset or at power failure.

User Port Serial Settings

Using Display/Keypad

The communication settings for the user port can be changed via the serial line or by using the optional display/keypad. The communication settings for the service port are fixed and not changeable.

1. Press any of the arrow buttons to open the MAIN MENU.
2. Select **Interfaces** and press the ►arrow button to confirm your selection.
3. Select **Serial interface** and press the ►arrow button to confirm your selection.
4. Select **Bit rate/Serial format/Comm. mode** by pressing the **CHANGE** button. Use the ▲▼ arrow buttons to select and press **SELECT** to confirm your selection.
5. If you selected RUN communication mode, select **RUN** interval for and press **SET** to confirm your selection.
6. Use the arrow buttons to set the measuring interval and the unit. Press **OK** to confirm your settings.
7. If you selected POLL communication mode, select POLL address and press **SET** to confirm your selection.
8. Use the arrow buttons to set the transmitter address. Press **OK** to confirm the setting.
9. Use the arrow buttons to select **ECHO**. Press **ON** to turn to it on. Press **OFF** to turn it off.
10. Press **EXIT** to return to the basic display.

The new user port settings set using the display/keypad are effective immediately.

Using Serial Line

SERI

Use the serial line command **SERI** [*b p d s*] to set communication settings for the user port.

SERI [*b p d s*]

where

b = Bit rate (110, 150, 300, 600, 1200, 2400, 4800, 9600,19200, 38400, 57600, 115200)
p = Parity (n = none, e = even, o = odd)
d = Data bits (7 or 8)
s = Stop bits (1 or 2)

Example:

```
>SERI 600 N 8 1
600 N 8 1
>
```

You need to reset the transmitter to activate the new communication settings set with command SERI.

The settings can be changed one parameter at a time or all parameters at once:

```
>SERI O              changing parity only
4800 O 7 1
>SERI 600 N 8 1      changing all parameters
600 N 8 1
>
```

SMODE

Use the command **SMODE** to set the user port start-up operating mode.

SMODE [*xxxx*]

where

xxx = STOP, RUN or POLL

Table 26 Selection of Output Modes

Mode	Output	Available Commands
STOP	Only with the **SEND** command	All (default mode)
RUN	Automatic output	Only command S
POLL	Only with the **SEND** [*addr*] command	Use with RS-485 buses, see Operation of the RS-485 Module on page 121.

Selected output mode will be activated after power outages.

INTV

Use the command **INTV** to set the outputting interval for the RUN mode.

INTV [*xxx yyy*]

where

xxx = Output interval (0 ... 255). 0: the fastest possible output rate.
yyy = Unit (s, min or h)

Example:

```
>INTV 10 min
Output intrv. :  10 min
>
```

ECHO

Use the command **ECHO** to set the user port echo. The command either enables or disables echo of characters received.

ECHO [*x*]

where

x = ON (default) or
= OFF

NOTE You can use the SERI, SMODE, INTV and ECHO commands to change/view the user port settings even if you are currently connected to the service port.

Data Filtering

The averaging data filter calculates an average over a certain period of time. The lowest measurement noise is achieved with the extended filtering. There are three filtering levels available.

Table 27 Filtering Levels

Setting	Filtering level
OFF	No filtering
ON (default)	Standard = short filtering (approximately 15 s moving average)
EXTENDED	Extended filtering (default: approximately 1 min average)

Use display/keypad to set the filtering level.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Measuring** by pressing the ► arrow button.
3. Select **Filtering** and press **CHANGE** to confirm your selection.
4. Select **Off/Standard/Extended** and press **SELECT** to confirm your selection.
5. Press **EXIT** to return to the basic display.

FILT

Use the serial line command **FILT** [*xxx*] to set the filtering level.

FILT [*xxx*]

where

xxx = OFF, ON or EXT (default = OFF)

Device Information

Use the display/keypad or the serial line to display the device information.

Press the **INFO** button in the basic display to see the following information:

- Current sensor operation (for example, chemical purge), if any, in progress
- Present or past unacknowledged errors, if any
- Device information
- Adjustment information fed by the user
- Measuring settings
- Information on chemical purge settings (when applicable)
- Display Alarm settings
- Serial interface information
- Network settings and status of the LAN and WLAN interfaces
- Analog output information
- Relay output information (when applicable)

Figure 57 Device Information on Display

Proceed in the information views by pressing the **MORE** button as many times as you get the desired information. You can browse through the information displays also with arrow buttons. Press **OK** to return to the basic display.

?

Use the serial line command **?** to check the current transmitter configuration. Command **??** is similar but can also be used if the transmitter is in POLL mode.

Example:

```
>?
HMT330 / 4.03
Serial number  : B2930015
Batch number   : B2350091
Adjust. date   : 2006-07-19
Adjust. info   : Helsinki / FIN
Date           : 2007-05-30
Time           : 13:41:55
Serial mode    : STOP
Baud P D S     : 4800 E 7 1
```

```
Output interval: 0 s
Address        : 0
Echo           : ON
Pressure       : 1013.25 hPa
Filter         : OFF
Ch1 output     : 4...20mA
Ch2 output     : 4...20mA
Ch1 RH    low  : 0.00 %RH
Ch1 RH    high : 100.00 %RH
Ch2 T     low  : -40.00 'C
Ch2 T     high : 60.00 'C
Module 1       : LOGGER-1
Module 2       : not installed
>
```

HELP

Use the command **HELP** to list the commands.

Example:

```
>help
?         ACAL      ADDR      AERR      ALSEL
ASCL      ASEL      CDATE     CLOSE     CODE
CRH       CT        CTA       CTEXT     DATE
DELETE    DIR       DSEL      DSEND     ECHO
ERRS      FCRH      FDATE     FILT      FORM
FST       FTIME     HELP      INTV      ITEST
MODS      NET       OPEN      PLAY      PRES
R         RESET     SEND      SERI      SMODE
TEST      TIME      UNDELETE  UNIT      VERS
WLAN      XPRES
>
```

ERRS

Use the command **ERRS** to display transmitter error messages, see Table 28 on page 136.

Example:

```
>ERRS
NO ERRORS
>
```

Example:

```
>ERRS
FAIL
Error: Temperature measurement malfunction
Error: Humidity sensor open circuit
>
```

VERS

Use the command **VERS** to display software version information.

Example:

```
>vers
HMT330 / 5.00
>
```

Resetting Transmitter Using Serial Line

RESET

This command resets the device. The user port switches to start-up output mode selected with command SMODE.

Locking Menu/Keypad by Using Serial Line

LOCK

Use the **LOCK** command to prevent the user from entering the menu using the keypad, or to lock the keypad completely. You can optionally set a 4-digit PIN code, for example 4444.

If a PIN code has been set, the user will be prompted to enter the code when trying to access the menu. Entering the code correctly will disable the lock until the user returns back to the basic view.

LOCK [*x*] [*yyyy*]

where

x = Keypad locking level, range 0...2. The options are:
0 - No lock (enables full access)
1 - Menu locked, but graphs are accessible
2 - Keypad completely disabled

yyyy = 4-digit PIN code. The code can only be set when keypad locking level is 1.

Examples:

```
>lock 1 4444
Keyboard lock  : 1 [4444]
>

>lock 1
Keyboard lock  : 1
>
```

Data Recording

Data recording function is always on and collects data automatically into the memory of the device. If the optional data logger module is installed, the transmitter uses it automatically. Recorded data does not disappear from the memory when the power is switched off. Collected data can be observed in a form of a graph in the graphical view of the display or it can be listed out by using the serial line or MI70 Link program.

Selecting Data Recording Quantities

If the device is provided with the optional display, the recorded quantities are always those selected for the display. Up to three quantities can be recorded at a time. For instructions on how to select the display quantities with the keypad, see section Changing Quantities and Units on page 92.

DSEL

Use the serial line command **DSEL** to select the quantities to be recorded if the transmitter is not equipped with display/keypad.

DSEL [*xxx*]

where

xxx = Data recording quantity. See Table 2 on page 17 and Table 3 on page 18 for the quantities.

Example:

```
>dsel rh t tdf
 RH T Tdf
>
```

Enter the command without parameters and press **ENTER** to display the current recording parameters.

View Recorded Data

If the device is provided with the optional display, the graphical display shows the data of the selected quantities, one at a time. See section Graphic History on page 64 for details about graphical display.

You may also dump the logged data to the serial line in numeric form with the following commands.

DIR

Use the serial line and enter the **DIR** command to check the available files.

Without the data logger module, the device records six files (six observation periods) for each selected quantity. The data logger raises the number of recorded files to seven for each quantity. Thus, the total amount of the files varies between 6 and 21. See Table 10 on page 65.

Select, for example, three quantities (RH, T, and Tdf). The last column illustrates the number of data points that has been stored in the file.

Example (data logger module installed):

```
>dir
   File description         Oldest data available       No. of points
1  RH   (10 s intervals)    2007-05-30 08:26:50         13996800
2  RH   (90 s intervals)    2007-05-30 05:25:30         1555200
3  RH   (12 min intervals)  2007-05-29 05:48:00         194400
4  RH   (2 h intervals)     2007-05-19 02:00:00         19440
5  RH   (12 h intervals)    2007-03-23 12:00:00         3240
6  RH   (3 d intervals)     2006-04-20 00:00:00         540
7  RH   (12 d intervals)    2002-12-16 00:00:00         135
8  T    (10 s intervals)    2007-05-30 08:26:50         13996800
9  T    (90 s intervals)    2007-05-30 05:25:30         1555200
10 T    (12 min intervals)  2007-05-29 05:48:00         194400
11 T    (2 h intervals)     2007-05-19 02:00:00         19440
12 T    (12 h intervals)    2007-03-23 12:00:00         3240
13 T    (3 d intervals)     2006-04-20 00:00:00         540
14 T    (12 d intervals)    2002-12-16 00:00:00         135
15 Tdf  (10 s intervals)    2007-05-30 08:26:50         13996800
16 Tdf  (90 s intervals)    2007-05-30 05:25:30         1555200
17 Tdf  (12 min intervals)  2007-05-29 05:48:00         194400
18 Tdf  (2 h intervals)     2007-05-19 02:00:00         19440
19 Tdf  (12 h intervals)    2007-03-23 12:00:00         3240
20 Tdf  (3 d intervals)     2006-04-20 00:00:00         540
21 Tdf  (12 d intervals)    2002-12-16 00:00:00         135
>
```

Example (without data logger module):

```
>dir
   File description         Oldest data available   No. of points
1  RH   (10 s intervals)    2008-04-11 23:41:10     135
2  RH   (90 s intervals)    2008-04-11 20:41:11     135
3  RH   (12 min intervals)  2008-04-10 21:03:41     135
4  RH   (2 h intervals)     2008-03-31 18:03:41     135
5  RH   (12 h intervals)    2008-02-04 12:03:41     135
6  RH   (3 d intervals)     2007-03-04 00:03:41     135
7  T    (10 s intervals)    2008-04-11 23:41:11     135
8  T    (90 s intervals)    2008-04-11 20:41:11     135
9  T    (12 min intervals)  2008-04-10 21:03:41     135
10 T    (2 h intervals)     2008-03-31 18:03:41     135
11 T    (12 h intervals)    2008-02-04 12:03:41     135
12 T    (3 d intervals)     2007-03-04 00:03:41     135
13 Tdf  (10 s intervals)    2008-04-11 23:41:11     135
14 Tdf  (90 s intervals)    2008-04-11 20:41:11     135
15 Tdf  (12 min intervals)  2008-04-10 21:03:41     135
16 Tdf  (2 h intervals)     2008-03-31 18:03:41     135
17 Tdf  (12 h intervals)    2008-02-04 12:03:41     135
18 Tdf  (3 d intervals)     2007-03-04 00:03:41     135
>
```

PLAY

Use the **PLAY** command to output the selected file to the serial line. If the data logger module is installed, you can specify an interval to be outputted.

Data in the output is <TAB> delimited. This is compatible with most spreadsheet programs. Before giving the command, set the local date and time with **TIME** and **DATE** commands, if needed.

PLAY [*x*] [*start_date start_time end_date end_time*]

where

x = Number of the data file that will be outputted, range 0...21. The numbers correspond to the output of the DIR command; refer to the example on page 106.
Selecting number 0 will output all data files.

start_date = Starting date of the interval to be outputted. Must be given in the following format: yyyy-mm-dd

start_time = Starting time of the interval to be outputted. Must be given in the following format: hh:mm:ss

end_date = Ending date of the interval to be outputted. Must be given in the following format: yyyy-mm-dd

end_time = Ending time of the interval to be outputted. Must be given in the following format: hh:mm:ss

Example:

```
>play 3 2007-05-05 00:00:00 2007-05-06 00:00:00
RH   (12 min intervals) 2007-05-05 00:00:00    121
Date        Time        trend   min     max
yyyy-mm-dd  hh:mm:ss    %RH     %RH     %RH
2007-05-05  00:00:00    19.16   18.99   19.33
2007-05-05  00:12:00    19.30   19.09   19.55
2007-05-05  00:24:00    20.01   19.28   21.17
2007-05-05  00:36:00    21.21   20.98   21.44
2007-05-05  00:48:00    19.57   17.72   21.11
2007-05-05  01:00:00    19.09   18.62   19.84
...
```

The <**ESC**> key can be used to interrupt the output listing.

NOTE Output of large amounts of recorded data can result in huge data files and take a long time, up to several days for the entire memory of the data logger at 10 second resolution. To make it easier to process the data it is recommended to select the largest suitable data interval, and to specify the start and end times carefully.

Deleting the Recorded Files

You can delete the recorded data files using the keypad/display, or the **DELETE** command on the serial line. The deletion is always done for all data; you cannot delete individual files.

Note that the transmitter automatically overwrites the old data when the memory is full, so manual deletion of the recorded files is not necessary in normal use.

To delete the data files using the keypad/display:

1. Press any of the arrow buttons to open the **MAIN MENU.**
2. Select **System** by pressing the ► arrow button.
3. Select **Clear graph memories** by pressing the **CLEAR** button. Press the **YES** button to confirm the selection.

CAUTION	This function clears the entire data history of the transmitter, including all graphs and the content of the optional data logger module.

UNDELETE

Similarly to the **DELETE** command, the **UNDELETE** command is used without any arguments. It will recover all deleted data that has not been overwritten yet.

Analog Output Settings

The analog outputs are set in the factory according to the order form. In case you want to change the settings, follow these instructions. See section Third Analog Output on page 50.

Changing Output Mode and Range

Both output channels have their own DIP switch module with 8 switches; see the position in Figure 2 on page 20 (DIP switches for analog output settings).

1. Select the current/voltage output; switch ON either of the switches, 1 or 2.
2. Select the range; switch ON one of the switches from 3 to 7.

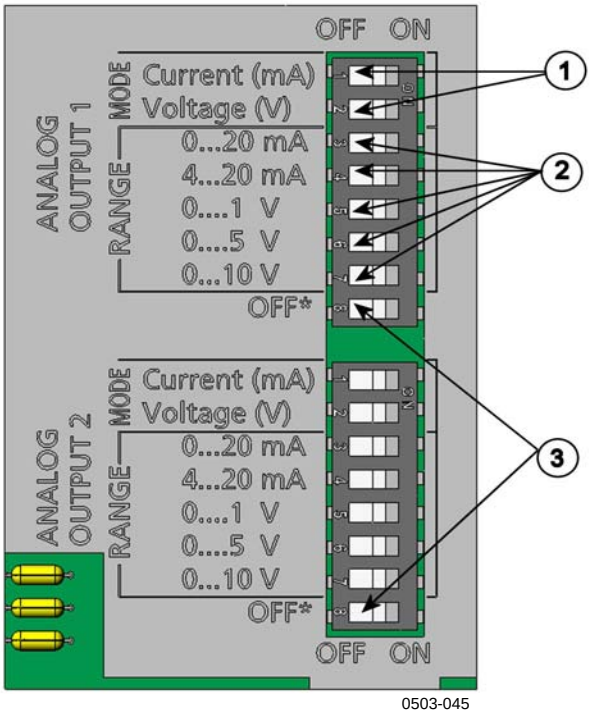


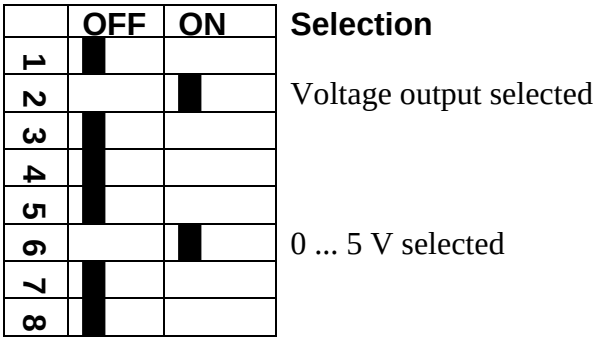
Figure 58 Current/Voltage Switches of Output Modules

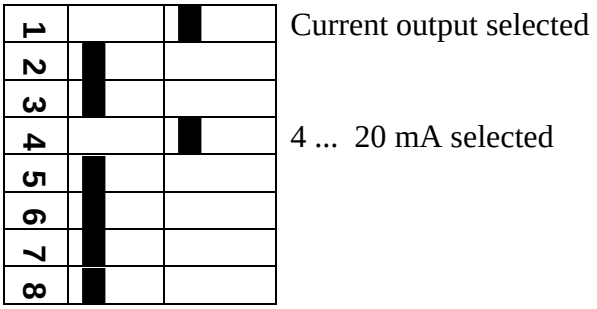
The following numbers refer to Figure 58 above:

1 = Current/voltage selection output switches (from 1 to 2)
2 = Current/voltage range selection switches (from 3 to 7) in analog output 1 and 2.
3 = Switches for service use only. Keep in OFF position always.

NOTE	Only one of the switches 1 or 2 must be ON at a time. Only one of the switches 3 to 7 must be ON at a time.

Example: 0 ... 5 V voltage output selected for channel 1 and 4 ... 20 mA selected for channel 2.





NOTE If you have customized the error output setting (**AERR**), check that the set error values are still valid after changing the output mode/range, see section Analog Output Fault Indication Setting on page 114.

Analog Output Quantities

Use the display/keypad to change and scale the analog output quantities.

1. Press any of the arrow buttons to open the **MAIN MENU.**
2. Select **Interfaces** by pressing the ► arrow button.
3. Select **Analog outputs** by pressing the ► arrow button.
4. Select **Output 1/2/3** by pressing the ► arrow button.
5. Select **Quantity** by pressing the ▲▼ arrow buttons. Confirm your selection by pressing **CHANGE**.
6. Select the quantity by using the arrow buttons. Press **SELECT** to confirm your selection.

7. Select **Scale,** lower limit, by pressing the ▲▼arrow buttons. Press **SET** to confirm your selection. Press **OK** to confirm your setting.
8. Select the upper limit by pressing the ▲▼arrow buttons. Use the arrow buttons to set the upper limit value. Press **SET** to confirm your selection. Press **OK** to confirm your setting.
9. Press **EXIT** to return to the basic display.

AMODE/ASEL

Use the serial line to select and scale the analog output quantities. Connect the transmitter to the PC. Open the terminal connection between your PC and the transmitter.

1. Check the analog output modes with the **AMODE** command.

Example:

```
>amode
Ch1 output     : 0...1V
Ch2 output     : 0...1V
>
```

2. Select and scale the quantities for the analog outputs with the command **ASEL**. Note that the optional quantities can be selected only if they have been selected when ordering the device.

ASEL [*xxx yyy zzz*]

where

xxx = Quantity of channel 1
yyy = Quantity of channel 2
zzz = Quantity of the optional analog output channel 3

Enter always all the quantities for all outputs. For quantities and their abbreviations see Table 2 on page 17 and Table 3 on page 18.

Use the command **ASEL** [*xxx yyy*] as shown in the example below when using a device with two analog outputs.

Example:

```
>asel rh t
Ch1 (RH ) low  : 0.00 %RH ? 0
Ch1 (RH ) high : 100.00 %RH ? 100
Ch2 (T  ) low  : -40.00 'C ? -50
Ch2 (T  ) high : 60.00 'C ? 80
>
```

Analog Output Tests

Use the display/keypad for testing to test the operation of the analog by forcing the outputs to known values. Measure then the outputs with a current/voltage meter.

1. Press any of the arrow buttons to open the **MAIN MENU.**
2. Select **System** by pressing the ► arrow button.
3. Select **Diagnostics** by pressing the ► arrow button.
4. Select **Analog output tests** by pressing the ► arrow button.
5. Select one of the testing options **Force 0%/50%/100% of scale.** Press **TEST** to confirm your selection. All outputs are tested simultaneously. The actual output value depends on the selected range.
6. Press **OK** to stop testing. Press **EXIT** to return to the basic display.

ITEST

Use the serial line to test the operation of the analog outputs. Use the command **ITEST** to force the analog outputs to entered values. The set values remain valid until you enter the command ITEST without parameters or RESET the transmitter.

ITEST [*aa.aaa bb.bbb*]

where

aa.aaa = Current or voltage value to be set for channel 1 (mA or V)
bb.bbb = Current or voltage value to be set for channel 2 (mA or V)

Example:

```
>itest 20 5
Ch1 (Td )      :           *        20.000 mA   H'672A
Ch2 (T  )      :           *         5.000 mA   H'34F9
>itest
Ch1 (Td )      :    -23.204 'C     16.238 mA   H'FFFE
Ch2 (T  )      :     22.889 'C      8.573 mA   H'5950
>
```

Analog Output Fault Indication Setting

Factory default state for analog outputs during error condition is 0 V/ 0 mA. Please be careful when selecting the new error value. The error state of the transmitter should not cause unexpected problems in process monitoring.

Use the display/keypad to set the analog output fault indication.

1. Press any of the arrow buttons to open the **MAIN MENU.**
2. Select **Interfaces** by pressing the ► arrow button.
3. Select **Analog Outputs** by pressing the ► arrow button.
4. Select **Output 1/2/3** by pressing the ► arrow button.
5. Select Fault indication. Press **SET** to confirm your selection. Enter the fault indication value by using the arrow buttons. Press **OK** to confirm your setting. This value is outputted if a transmitter error occurs.
6. Press **EXIT** to return to the basic display.

AERR

Use the serial line **AERR** command to change the error output.

AERR

Example:

```
>aerr
Ch1 error out  : 0.000V ? 5.0
Ch2 error out  : 0.000V ? 5.0
>
```

NOTE	The error output value must be within a valid range of the output mode.

NOTE	The error output value is displayed only when there are minor electrical faults such as humidity sensor damage. When there is a severe device malfunction, the error output value is not necessarily shown.

Operation of Relays

Quantity for Relay Output

A relay monitors the quantity chosen for the relay output. Any of the quantities available can be chosen.

Measurement-Based Relay Output Modes

Relay Setpoints

When the measured value is in between the "above" and "below" values, the relay is passive. When choosing lower value as "above" value and higher value as "below" value, the relay is passive when the measured value is not between the setpoints. You can also set only one setpoint. See Figure 59 below for illustrative examples of the different measurement-based relay output modes.

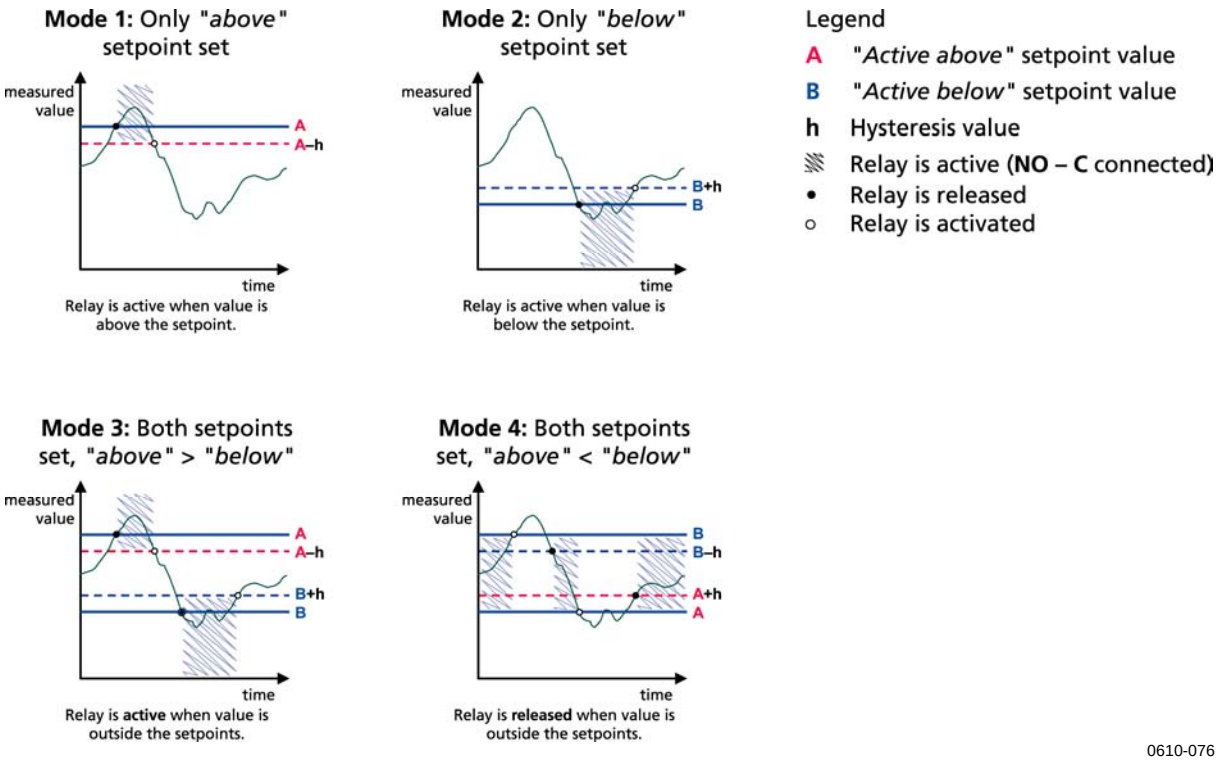


Figure 59 Measurement-Based Relay Output Modes

Mode 4 is usually used if an alarm needs to be triggered when the measured value exceeds a safe range. The relay is active when measurement is in range, and is released if the value goes out of range or the measurement fails.

NOTE	If the measurement of the selected quantity fails or the transmitter loses its power, the relay is released.

Hysteresis

Hysteresis function is to prevent the relay switching back and forth when the measured value is near to the setpoint values.

Relay is activated when the measured value passes the exact value of the setpoint. When returning and passing the setpoint again relay is not released before the value reaches the setpoint increased/decreased by the hysteresis value.

Hysteresis should be smaller than difference of the setpoints.

Example: When the 'active above' value is 60 %RH and the hysteresis value is 5 %RH, relay activates when the relative humidity reaches 60 %RH. As the humidity decreases, relay releases at 55 %RH.

NOTE	If both setpoints are specified and "above" setpoint is lower than "below" setpoint, the hysteresis works in the opposite direction, that is, relay is **released** when the measured value passes the exact value of the setpoint.

Relay Indicating Transmitter Error Status

You can set a relay to follow the operation status of the device. By selecting FAULT/ONLINE STATUS for output quantity a relay changes state on the basis of the operation status as follows:

FAULT STATUS

Normal operation: relay active (C and NO outputs are closed)

Not measuring state (error state or power off): relay released (C and NC outputs are closed)

ONLINE STATUS

Live measurement (data available): relay active (C and NO outputs are closed)

No live data (for example: error state, chemical purge or adjustment mode): relay released (C and NC outputs are closed)

See Figure 60 below for illustrative examples of the FAULT/ONLINE STATUSrelay output modes.

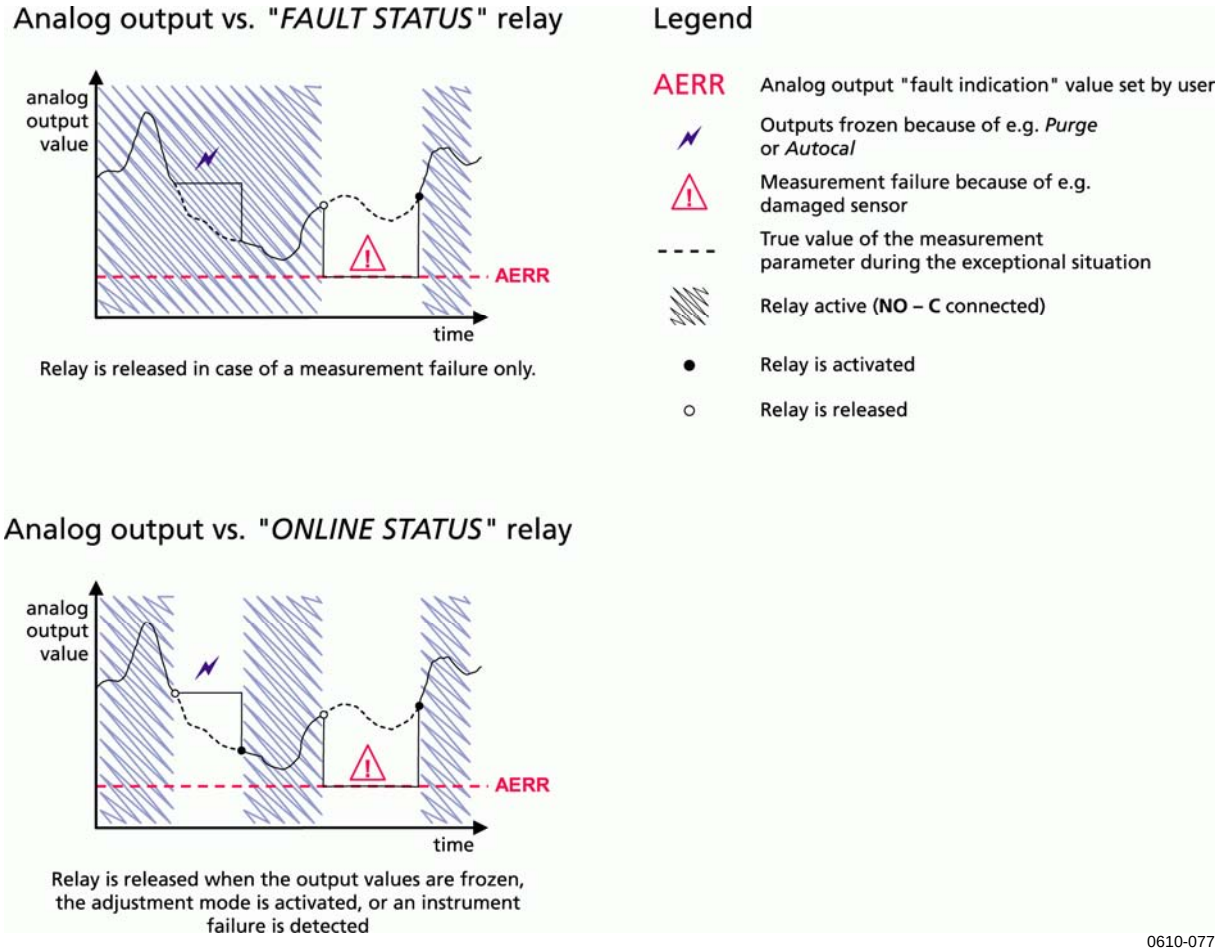

Analog output vs. "FAULT STATUS" relay
analog output value
AERR
time
Relay is released in case of a measurement failure only.
Legend
AERR
Analog output "fault indication" value set by user
Outputs frozen because of e.g. Purge or Autocal
Measurement failure because of e.g. damaged sensor
True value of the measurement parameter during the exceptional situation
Relay active (NO – C connected)
Relay is activated
Relay is released
Analog output vs. "ONLINE STATUS" relay
analog output value
AERR
time
Relay is released when the output values are frozen, the adjustment mode is activated, or an instrument failure is detected
0610-077

Figure 60 FAULT/ONLINE STATUS Relay Output Modes

FAULT/ONLINE STATUS relays are usually used in conjunction with an analog output to obtain validity information for the output value.

NOTE	If transmitter loses its power, all status-based relays are released similarly to the case of an instrument failure.

Enabling/Disabling Relays

You can deactivate the relay outputs for example for service purposes of your system.

Setting Relay Outputs

NOTE

When having only one relay module installed, its relays are called 'relay 1' and 'relay 2'.

When having two relay modules, the relays of the module connected to slot **MODULE 1** are called 'relay 1' and relay 2' and relays connected to slot **MODULE 2** are called 'relay 3' and 'relay 4'

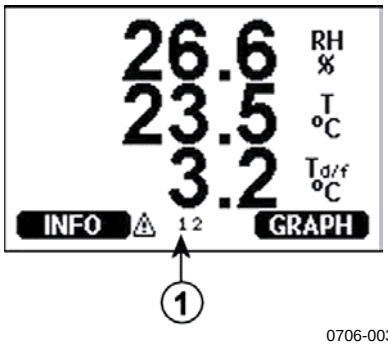


Figure 61 Relay Indicators on Display

The following number refers to Figure 61 above:

1 = Lists enabled relays. Activation state shown in black. Disabled relays are not shown.

Use the display/keypad to set the relay outputs.

1. Press any of the arrow buttons to open the **MAIN MENU**.
2. Select **Interfaces**, confirm by pressing the ►arrow button.
3. Select **Relay outputs**, confirm by pressing the ►arrow button.
4. Select **Relay 1/2/3/4**, confirm by pressing the ►arrow button.
5. Select the **Quantity**, confirm by pressing **Change**. Select the Quantity by using the arrow buttons. Confirm your selection by pressing **Select**.
6. Select **Act. above / Act**. below. Press SET to confirm your selection. (If asked, select **MODIFY** if you want to set the setpoint by using the arrow buttons. Select **REMOVE** if you want to remove the setpoint.)

7. Select **Hysteresis** by using the arrow buttons. Press **SET** to set the hysteresis. Press **OK**.
8. Select **Relay enable** by using the arrow buttons, press **ON/OFF** to enable/disable the relay.

RSEL

Use the serial line to select the quantity, setpoints and hysteresis or enable/disable the relay outputs. Enter the **RSEL** command.

RSEL [*q1 q2 q3 q4*]

where

q1 = quantity for the relay 1 or Fault/Online
q2 = quantity for the relay 2 or Fault/Online
q3 = quantity for the relay 3 or Fault/Online
q4 = quantity for the relay 4 or Fault/Online

Factory setting: all relays disabled.

Use the quantity abbreviations presented above. See Table 2 on page 17 and Table 3 on page 18.

Example of window limit switch: Selecting relay 1 to follow dewpoint/frost point temperature measurement and relay 2 to follow temperature measurement. Two relay setpoints are set for both relays.

```
>rsel rh t
Rel1 RH   above: 0.00 %RH ? 30
Rel1 RH   below: 0.00 %RH ? 40
Rel1 RH   hyst : 0.00 %RH ? 2
Rel1 RH   enabl: OFF ? ON
Rel2 T    above: 0.00 'C ? 30
Rel2 T    below: 0.00 'C ? 40
Rel2 T    hyst : 0.00 'C ? 3
Rel2 T    enabl: OFF ? ON
>
```

Example of normal limit switch: Selecting relay 1 to follow relative humidity, relay 2 to follow temperature, relay 3 to follow dewpoint and relay 4 to follow dewpoint. One setpoint is chosen for all the outputs.

```
>rsel rh t td td
Rel1 RH   above: 60.00 %RH ? 70
Rel1 RH   below: 70.00 %RH ? -
Rel1 RH   hyst : 2.00 %RH ? 2
Rel1 RH   enabl: ON ? on
Rel2 T    above: 50.00 'C ? 60
Rel2 T    below: 40.00 'C ? -
Rel2 T    hyst : 2.00 'C ? 2
Rel2 T    enabl: ON ? on
Rel3 Td   above: 5.00 'C ? 10
Rel3 Td   below: 0.00 'C ? -
Rel3 Td   hyst : 1.00 'C ? 1
Rel3 Td   enabl: OFF ? on
Rel4 Td   above: 0.00 'C ? 20
Rel4 Td   below: 0.00 'C ? -
Rel4 Td   hyst : 0.00 'C ? 2
Rel4 Td   enabl: OFF ? on
>
```

Example of using relay 1 as fault alarm: selecting relay 1 to follow the fault status and relay 2 to follow the temperature measurement.

```
>rsel fault t
Rel1 FAUL above: -
Rel1 FAUL below: -
Rel1 FAUL hyst : -
Rel1 FAUL enabl: ON ?
Rel2 T    above: 0.00 'C ? 30
Rel2 T    below: 0.00 'C ? -
Rel2 T    hyst : 0.00 'C ? 2
Rel2 T    enabl: OFF ? ON
>
```

Testing Operation of Relays

Testing activates relays even if they are disabled.

Use the module push buttons to activate the relays. Press the **REL 1** or **REL 2** button to activate the corresponding relay.

Relay is activated:	led is lit
Relay is not activated:	led is not lit

Use the display/keypad to test the operation of relays.

1. Open the **MAIN MENU** by pressing any of the arrow buttons.
2. Select **System**, press the ►arrow button.
3. Select **Diagnostics**, press the ►arrow button.
4. Select **Relay tests**, press the ►arrow button.
5. Select **Invert relay 1...** , press **TEST**. Now the selected relay output is forced to opposite state. Press **OK** to return to normal operation.
6. Press **EXIT** to return to the basic display.

RTEST

Use the serial line command **RTEST** to test the operation of the relays.

RTEST [*x1 x2 x3 x4*]

where

x = ON/OFF

Example: Activate and then release all four relays.

```
>rtest on on on on
 ON ON ON ON
>
>rtest off off off off
 OFF OFF OFF OFF
>
```

Enter the command **RTEST** without parameters to stop testing.

Operation of the RS-485 Module

The RS-485 interface enables communication between RS-485 network and HMT330 transmitter. The RS-485 interface is isolated and offers a maximum communications rate of 115 200 bits/s. (For maximum bus length of 1 km, use bit rate 19200 b/s or less.)

When selecting an RS-232-RS-485 converter for the network, avoid self powered converters as they don't necessarily support the needed power consumption.

Echo function shall be always disabled (OFF) when using the 2-wire connection. When using the 4-wire connection you can disable/enable the echo setting.

NOTE	User port on HMT330 main board cannot be used and connected when RS-485 module is connected. Service port is operating normally.

Networking Commands

Set the RS-422/485 interface by using the following commands. The other serial line commands are presented in section List of Serial Commands on page 87.

RS-485 configuration commands **SERI; ECHO; SMODE; INTV** and **ADDR** may be entered by using either the service port or RS-422/485 port. Also the optional display/keypad can be used, see section User Port Serial Settings on page 98.

SDELAY

With the **SDELAY** command you can set delay (response time) for user port (RS232 or RS485), or view currently set delay value. Value corresponds to tens of milliseconds (eg. 5 = 0.050s minimum answer delay). The value can be set between 0...254.

Example:

```
>sdelay
Serial delay   : 0 ? 10

>sdelay
Serial delay   : 10 ?
```

SERI

Use the **SERI** command to input RS-485 bus settings.

SERI [*b p d s*]

where

where

b = bit rate (300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200)
p = parity (n = none, e = even, o = odd)
d = data bits (7 or 8)
s = stop bits (1 or 2)

ECHO

Use the **ECHO** command to enable/disable echo of characters received over the serial line.

ECHO [*x*]

where

x = ON/OFF (default = OFF)

When using 2-wire connection, echo must be always disabled.

SMODE

Use the **SMODE** command to set the default serial interface mode.

SMODE [*xxxx*]

where

xxxx = STOP, RUN or POLL
In STOP mode: measurements output only by command SEND, all commands can be used
In RUN mode: outputting automatically, only command S can be used to stop.
In POLL mode: measurements output only with command SEND [*addr*].

When several transmitters are connected to the same line, each transmitter must be entered an own address in the initial configuration, and POLL mode must be used.

INTV

Use the **INTV** command to set the RUN mode output interval.

INTV [*n xxx*]

where

n = 1 - 255
xxx = S, MIN or H

This command sets the RUN mode output interval. The time interval is used only when the RUN mode is active. For example, the output interval is set to 10 minutes.

```
>INTV 10 min
Output intrv. :    10 min
>
```

Setting RUN output interval to zero enables the fastest possible output rate.

ADDR

Addresses are required only for POLL mode (see serial line command SMODE on page 99). Use the **ADDR** command to input the RS-485 transmitter address.

OPEN [*aa*]

where

aa = address (0 ... 99) (default = 0)

Example: the transmitter is configured to address 99.

```
>ADDR
Address : 2 ?  99
>
```

SEND

Use the SEND command to output the reading once in POLL mode:

SEND [*aa*]

where

aa = address of the transmitter

OPEN

When all transmitters on the RS-485 bus are in POLL mode the **OPEN** command sets one transmitter temporarily to STOP mode so that other commands can be entered.

OPEN [*aa*]

where

aa = address of the transmitter (0 ... 99)

CLOSE

The **CLOSE** command switches the transmitter back to the POLL mode.

Example:

```
>OPEN 2   (opens the line to transmitter 2, other
          transmitters stay in POLL mode)
>CRH      (for example, calibration performed)
...
>CLOSE    (line closed)
```

Sensor Functions

Chemical Purge (Optional)

In some specific applications the sensor gain may decrease gradually due to an interference caused by a particular chemical present in the measured gas, for example. The decrease of sensor gain due to an interfering chemical and the effect of the chemical purge process are illustrated below, see Figure 62 below. The sensor polymer absorbs the interfering chemical; and this reduces the ability of the polymer to absorb water molecules and consequently the sensor gain decreases. In chemical purge, heating the humidity sensor to a temperature level of approximately +160 °C for several minutes evaporates the interfering chemical.

The purge function starts with heating stage, continues with settling and when the temperature of the sensor is decreased the transmitter returns to normal mode. The whole cycle takes about 6 minutes.

NOTE	Chemical purge function locks the output values for about 6 minutes.

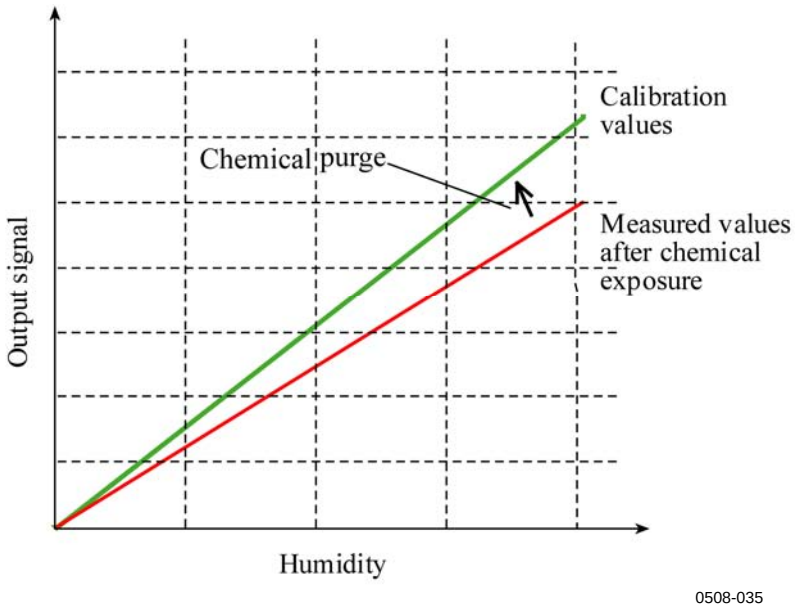


Figure 62 Decrease of Sensor Gain

Before starting the chemical purge note the following:

- The sensor is protected with a PPS grid with stainless steel netting, a stainless steel sintered filter or with membrane SST filter.
- The sensor temperature must be below 100 °C. At higher temperatures the chemicals evaporate spontaneously from the sensor and the chemical purge is not necessary.

Automatic Chemical Purge (Interval Purge)

When HMT330 leaves the factory the automatic chemical purge (if chosen) takes place repeatedly with the time intervals set in the factory. User can change the interval in which the purge takes place by using serial commands or with the optional display/keypad. This can be needed if the measuring environment contains high concentrations of interfering chemicals. The automatic chemical purge can also be turned off if necessary.

Manual Chemical Purge

The chemical purge should be performed always before calibration (see section Calibration and Adjustment on page 139) or when there is a reason to believe that a sensor has become exposed to an interfering chemical. Make sure that the temperature of the sensor has come down to normal temperature before starting a calibration.

Chemical Purge in Power Up

Chemical purge (start-up purge) can be set to start within 10 seconds from the power-up of the device.

Starting and Configuring Chemical Purge

Using Buttons on Motherboard

Start manual chemical purge by pressing simultaneously two PURGE buttons on the motherboard inside the transmitter for a few seconds. Indicator led flashes until purge is complete (up to 6 minutes).

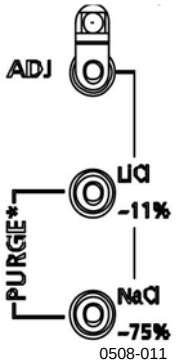


Figure 63 Purge Buttons on Motherboard

Using Display/Keypad (Optional)

Set the automatic and manual chemical purge by using the display/keypad.

1. Open the MAIN MENU by pressing any of the ▼▲◄► arrow buttons.
2. Select ►Measuring, press ►button.
3. Select ►Chemical purge, press ►button.

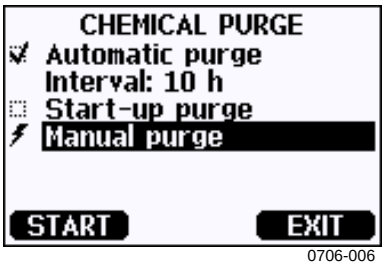


Figure 64 Chemical Purge Settings

- Turn on/off the automatic purge by selecting **Automatic purge,** press ►**ON/OFF** button.
- Set the automatic purge interval by selecting **Interval: ...**, press **SET.** Set the purge interval and the unit (hour/day) by using the arrow buttons. The interval must be 1 hour ... 10 days. Press **OK.**
- Select **Start-up purge** by using the arrow buttons. Press On/Off to turn the start-up purge on/off.
- Start manual purge by selecting **Manual purge** and pressing START.

4. Press **EXIT** to return to the basic display.

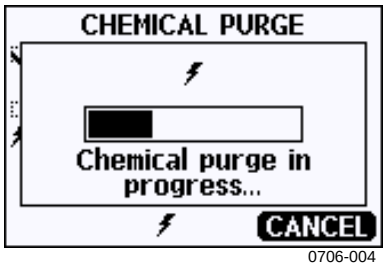


Figure 65 Performing Chemical Purge

Using Serial Line

PURGE

Enter the **PURGE** command to start chemical purge immediately.

```
>purge
Purge started, press any key to abort.
>
```

The prompt '>' appears when the heating period is over. However, the transmitter outputs are locked to the values measured before performing chemical purge until the settling time is over.

With **PUR** command you can enable or disable automatic and power-up chemical purge and set the interval for automatic purge. If the sensor is exposed to chemicals it is recommended to have the chemical purge done at least once in 720 min (=12 hours). In applications where the chemical exposure is not likely, the interval can be longer.

It is not recommended to change duration, settling, temperature or temperature difference.

PUR

Type **PUR** and press ENTER to proceed. The maximum interval is 14400 minutes (=10 days).

Example:

```
>pur
Interval Purge : OFF ?
Interval       : 720 min ?
Power-up Purge : OFF ?
Duration       : 120 s ?
Settling       : 240 s ?
Temperature    : 160 'C ?
Temp. diff.    : 0.5 'C ?
>
```

NOTE To activate the new interval settings immediately, reset the transmitter.

NOTE When chemical purge in power-up is enabled, wait about 6 min after power-up before taking measurements. The output channels are locked for the first operation minutes to the initial measured values

Sensor Heating

This function is optionally available only in transmitters with HUMICAP®180C or HUMICAP®180RC sensor. It should be used only with the warmed probe.

The sensor heating is recommended for the high humidity environments where even a small temperature differences can cause water to condense on the sensor. The sensor heating speeds up the recovery of the humidity sensor from condensation.

Sensor heating starts-up when the relative humidity of the measuring environment reaches the RH-value set by a user (RH-limit). The user can define the RH-sensor heating temperature as well as the duration of the heating.

After the heating cycle the humidity conditions are checked and new sensor heating is performed if the predefined conditions are reached again.

NOTE	During the sensor heating the outputs are locked to the values measured before the heating cycle.

Setting Humidity Sensor Heating

When the HMT330 leaves the factory the sensor heating follows the factory default values. You can enable/disable the function, change the RH-limit and define the heating temperature and duration of this function.

XHEAT

Enables/disables the sensor heating.

XHEAT [*xx*]

where:

xx = ON / OFF

```
>xheat on
Extra heat     : ON
>xheat off
Extra heat     : OFF
>
```

To configure the sensor heating use the XHEAT command without parameters. Enter the values after question mark. The available ranges include the following:

Extra heat RH -limit (heating function starts-up above the setpoint)	0 ... 100 %RH (default: 95 %RH)
Extra heating temperature	0 ... 200 ºC (default: 100 ºC)
Extra heating time	0 ... 255 s (default: 30 s)

Example:

```
>xheat
Extra heat     : OFF
Extra heat RH  : 95 ? 90
Extra heat temp: 100 ? 85
Extra heat time: 30 ? 10
>xheat on
Extra heat     : ON
>
```

CHAPTER 5

MAINTENANCE

This chapter contains information that is needed in basic maintenance of the product.

Periodic Maintenance

Cleaning

Clean the transmitter enclosure with a soft, lint-free cloth moistened with mild detergent.

Changing the Probe Filter

1. Turn the filter counter-clockwise to loosen it.
2. Remove the filter from the probe. Be careful not to touch the sensor with the filter. Without the filter in place, the sensor is easily damaged – handle the probe carefully.
3. Install a new filter on the probe. When using the stainless steel filter (for oil and fuel cell), take care to tighten the filter properly (recommended force 5 Nm).

New filters can be ordered from Vaisala, see section Options and Accessories on page 158.

Changing the Sensor

The user can change the HUMICAP180, HUMICAP180L2, and HUMICAP180R sensors. If the transmitter has the chemical purge and/or warmed probe option (which utilize the HUMICAP180C or HUMICAP180RC sensor), the sensor cannot be changed by the user.

Changing the sensor should be considered corrective maintenance, and it is not necessary in normal operation. If the accuracy of the transmitter does not seem to be within specification, it is more likely that the transmitter is in need of calibration and adjustment, and not sensor replacement. Refer to chapter Calibration and Adjustment on page 139.

NOTE When replacing the sensor, the new sensor must be of the same type as the old sensor (for example, HUMICAP180R). The sensor type can only be changed at a Vaisala Service Center.

1. Remove the filter from the probe. See the instructions in section Changing the Probe Filter on page 133.
2. Remove the damaged sensor and insert a new one. Handle the new sensor by the plastic socket. DO NOT TOUCH THE SENSOR PLATE.
3. Perform a calibration and adjustment as instructed in section Relative Humidity Adjustment after Sensor Change on page 144.
4. Attach a new filter on the probe. When using the stainless steel filter, take care to tighten the filter properly (recommended force 5 Nm).

Figure 66 Changing the Sensor

The following numbers refer to Figure 66 above:

1 = Pull out the sensor
2 = Plastic socket

Error States

In error state the quantity is not measured and the output is shown as follows:

- Analog channel outputs 0 mA or 0 V (you can use the serial line command **AERR** or display/keypad to change this fault indication value, see section Analog Output Fault Indication Setting on page 114.)
- The serial port outputs stars (***)
- The cover LED is blinking
- Optional display: error indicator is lit.

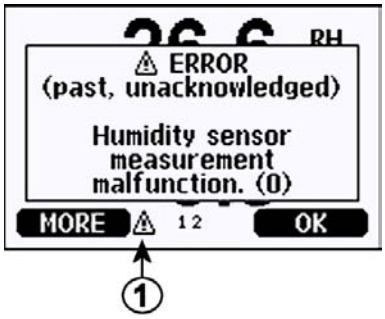


Figure 67 Error Indicator and Error Message

The following number refers to Figure 67 above:

1 = Error Indicator

- The error indicator disappears when the error state is over and you have checked the error message. Press the **INFO** button to display the error message.

You can also check the error message via the serial interface by using the command **ERRS**. In case of constant error, please contact Vaisala, see Vaisala Service Centers on page 138.

Table 28 Error Messages

Error Code	Error Message	Action
0	Humidity sensor measurement malfunction.	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt, water, ice or other contaminants.
1	Humidity sensor short circuit	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt, water, ice or other contaminants.
2	Humidity sensor open circuit	Check the integrity of the humidity probe and the probe cable.
3	Temperature sensor open circuit.	Check the integrity of the humidity probe and the probe cable.
4	Temperature sensor short circuit.	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt water, ice or other contaminants.
5	Temperature measurement malfunction	Check the integrity of the humidity probe and the probe cable. Clean the probe from dirt water, ice or other contaminants.
6	Temperature sensor current leak.	Check the integrity of the humidity probe and the probe cables. Clean the probes from dirt, water, ice or other contaminants.
7	Internal ADC read error	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
8	Additional temperature sensor short circuit	Check the integrity of the temperature probe and the probe cable. Clean the probe cable from dirt, water, ice or other contaminants.
9	Checksum error in the internal configuration memory	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
10	Internal EEPROM read error	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
11	Internal EEPROM write error	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
12 … 13	Add-on module 1 (or 2) connection failure	Turn off the power and check the module connection. Turn on the power.
14	Device internal temperature out of range	Ensure that the operating temperature is within the valid range.
15	Operating voltage out of range	Ensure that the operating voltage is within the valid range.
18	Internal ADC reference voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
19	Internal analog output reference voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
20 … 23	Configuration switches for analog output 1/2/3 set incorrectly	Check and re-set the switches, see page 55.
24 … 25	EEPROM failure on add-on module 1 (or 2)	Disconnect the power and check the analog output module connection.

Error Code	Error Message	Action
26	Communication module installed in incorrect add-on module slot	Disconnect the power and change the communication module to another module slot.
28 … 29	Unknown/incompatible module installed in add-on module slot 1 (or 2)	Ensure that the module is compatible with the HMT330.
30	Internal analog voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.
31	Internal system voltage out of range	Internal transmitter failure. Remove the transmitter and return the faulty unit to Vaisala Service.

Technical Support

For technical questions, contact the Vaisala technical support:

E-mail helpdesk@vaisala.com

Fax +358 9 8949 2790

Return Instructions

If the product needs repair, please follow the instructions below to speed up the process and to avoid extra costs to you.

1. Read the section Warranty on page 16.
2. Contact a Vaisala Service Center or a local Vaisala representative. The latest contact information and instructions are available from www.vaisala.com. Addresses of the Service Centers are provided in section Vaisala Service Centers on page 138.

   Please have the following information on hand:

   - serial number of the unit
   - date and place of purchase or last calibration
   - description of the fault
   - circumstances in which the fault occurs/occurred
   - name and contact information of a technically competent person who can provide further information on the problem

3. Pack the faulty product in a strong box of adequate size, with proper cushioning material to avoid damage.
4. Include the information specified in step 2 in the box with the faulty product. Also include a detailed return address.
5. Ship the box to the address specified by your Vaisala contact.

Vaisala Service Centers

Vaisala Service Centers perform calibrations and adjustments as well as repair and spare part services. See contact information below.

Vaisala Service Centers also offer accredited calibrations, maintenance contracts, and a calibration reminder program. Do not hesitate to contact them to get further information.

NORTH AMERICAN SERVICE CENTER
Vaisala Inc., 10-D Gill Street, Woburn, MA 01801-1068, USA.
Phone: +1 781 933 4500, Fax: +1 781 933 8029
E-mail: us-customersupport@vaisala.com

EUROPEAN SERVICE CENTER
Vaisala Instruments Service, Vanha Nurmijärventie 21 FIN-01670 Vantaa, FINLAND.
Phone: +358 9 8949 2658, Fax: +358 9 8949 2295
E-mail: instruments.service@vaisala.com

TOKYO SERVICE CENTER
Vaisala KK, 42 Kagurazaka 6-Chome, Shinjuku-Ku, Tokyo 162-0825, JAPAN.
Phone: +81 3 3266 9617, Fax: +81 3 3266 9655
E-mail: aftersales.asia@vaisala.com

BEIJING SERVICE CENTER
Vaisala China Ltd., Floor 2 EAS Building, No. 21 Xiao Yun Road, Dongsanhuan Beilu, Chaoyang District, Beijing, P.R. CHINA 100027.
Phone: +86 10 8526 1199, Fax: +86 10 8526 1155
E-mail: china.service@vaisala.com

www.vaisala.com

CHAPTER 6

CALIBRATION AND ADJUSTMENT

The HMT330 is fully calibrated and adjusted as shipped from factory. Typical calibration interval is one year. Depending on the application it may be good to make more frequent checks. Calibration must be done always when there is a reason to believe that the device is not within the accuracy specifications.

It is recommended that calibration and adjustment should be carried out by Vaisala. See section Vaisala Service Centers on page 138.

Calibration and adjustment is carried out either by using the push-keys on the motherboard, through the serial port or with the optional display/keypad.

(Vaisala portable instruments HM70 and HMI41 can also be used).

Opening and Closing the Adjustment Mode

1. Open the transmitter cover. The buttons needed in adjustment are on the left-hand side of the motherboard.
2. If the chemical purge option is available, it should be carried out always before calibration. To start chemical purge press simultaneously two **PURGE** push-keys (on the motherboard) for a few seconds. Red indicator led flashes with short pulses until purge is complete (up to 6 minutes).
3. Press the **ADJ** key to open the adjustment mode.
4. Press the **ADJ** key again to close the adjustment mode.

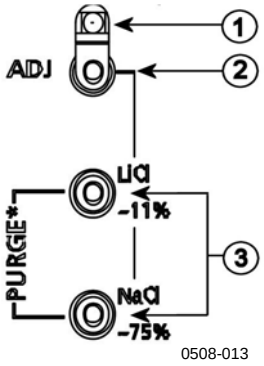


Figure 68 Adjustment and Purge Buttons

The following numbers refer to Figure 68 above:

1 = Indicator led
2 = Adjustment button
3 = Press the purge buttons simultaneously to start chemical purge (if available)

Adjustment menu is displayed only when **ADJ** button (on the motherboard inside the transmitter) is pressed.

Figure 69 Adjustment Menu

Table 29 Indicator Led Functions

Indicator Led Function	Description
LED off	adjustment locked
LED on	adjustment available
LED blinking evenly	measurement not stabilized
LED blinking with short pulses	performing chemical purge

NOTE If using a warmed probe (**HMT337 option**), probe heating will be interrupted when **ADJ** key is pressed. Allow sufficient time for the probe to reach ambient temperature before starting the adjustment procedure.

NOTE	Fixed pressure compensation value of 1013.25 hPa is used when in adjustment mode

Relative Humidity Adjustment

Using Push-Buttons

A simple push-button adjustment is carried out by using two relative humidity references: 11 % RH (LiCl) and 75 % RH (NaCl).

1. Carry out the chemical purge (if available).

LiCl reference

2. Press the **ADJ** button (see Figure 68 on page 140) on the motherboard to open the adjustment mode. The indicator led starts flashing.
3. Remove the filter from the probe and insert the probe into a measurement hole of the 11 % RH (LiCl) in the humidity calibrator HMK15. Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.
4. Wait at least 30 minutes for the sensor to stabilize (the indicator led is lit continuously). Adjustment cannot be done if the conditions are not stabilized (indicator led is flashing).
5. When the indicator led is lit continuously, press the button LiCl~11% to adjust the 11 % RH condition. After adjustment transmitter returns to normal operation mode (indicator LED is unlit).

NaCl reference

6. When adjusting in the second reference 75 % RH, press the **ADJ** button to open the adjustment mode. The indicator led starts flashing.
7. Insert the probe into a measurement hole of the 75 % RH (NaCl) reference chamber of the humidity calibrator HMK15. Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.

8. Wait at least 30 minutes for the sensor to stabilize (the indicator led is lit continuously). Adjustment cannot be done if the conditions are not stabilized (indicator led is flashing).
9. Press the button **NaCl 75 %** to adjust the 75 % RH condition. After adjustment transmitter returns to normal operation mode (indicator led is unlit).

Using Display/Keypad

Note that the difference between the two humidity references must be at least 50% RH.

1. Carry out the chemical purge (if available).
2. Press the **ADJ** button (opens the **ADJUSTMENT MENU**).
3. Select **Adjust RH measurement**, press ► button.
4. Select **1-point/ 2-point adjustment**, press. Press **START**.
5. Select the reference as guided by the display, press **SELECT**.

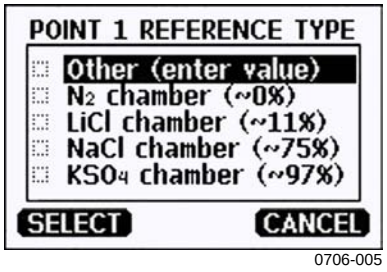


Figure 70 Selecting Point 1 Reference Type

6. Remove the filter from the probe and insert the probe into a measurement hole of the dry end reference chamber (for example, LiCl: 11 % RH in the humidity calibrator HMK15.) Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.
7. Wait at least 30 minutes for the sensor to stabilize. Follow the stabilization from the **GRAPH** display.
8. Press **READY** when stabilized. If you have chosen the **Other** reference value, enter now the reference value by using the arrow buttons.

   When carrying out the 2-point adjustment proceed to the next adjustment point and carry out the procedure as described in the previous items.
9. Answer **YES** to confirm the adjustment. Press **OK** to return to the adjustment menu.

10. Press **EXIT** to close the adjustment mode and return to the basic display. Before closing the adjustment mode, feed the adjustment information into the device, see section Feeding Adjustment Information on page 148.

Using Serial Line

Note that the difference between the two humidity references must be at least 50% RH.

1. Connect the HMT330 to a PC. See section Serial Line Communication on page 72. Open a terminal program.
2. Carry out the chemical purge (if available).
3. Press the **ADJ** button.
4. Remove the filter from the probe and insert the probe into a measurement hole of the dry end reference chamber (for example, LiCl: 11 % RH in the humidity calibrator HMK15). Use the adapter fitting for the probes of HMT334, HMT335, HMT337 and HMT338.
5. Enter the **CRH** command and press **ENTER.**

CRH

6. Wait at least 30 minutes for the sensor to stabilize.
7. Type **C** and press **ENTER** a few times to check if the reading is stabilized.
8. When the reading is stabilized, give the reference humidity after the question mark and press **ENTER.**

```
>crh

RH  :    11.25  Ref1 ? c
RH  :    11.25  Ref1 ? c
RH  :    11.25  Ref1 ? c
RH  :    11.24  Ref1 ? c
RH  :    11.24  Ref1 ? 11.3
Press any key when ready ...
```

9. Now the device is waiting for the high end reference. Insert the probe into the measurement hole of the high end reference chamber (for example, NaCl: 75 % RH chamber in the humidity calibrator HMK15). Use the adapter fitting for the HMT334, HMT335, HMT337 and HMT338 probes. Press any key when ready.

10. Let the probe stabilize for about 30 minutes. You can follow the stabilization by typing C and pressing **ENTER**.
11. When stabilized, type the high end reference value after the question mark and press **ENTER**.

```
>crh

RH  :    11.25  Ref1 ? c
RH  :    11.24  Ref1 ? c
RH  :    11.24  Ref1 ? 11.3
Press any key when ready ...

RH  :    75.45  Ref2 ? c
RH  :    75.57  Ref2 ? c
RH  :    75.55  Ref2 ? c
RH  :    75.59  Ref2 ? 75.5
OK
>
```

12. **OK** indicates that the adjustment has succeeded and the new calibration coefficients are calculated and stored. Enter the adjustment information (date and text) to the memory of the transmitter; see the commands **CTEXT** and **CDATE**.
13. Press the **ADJ** button on the motherboard to close the adjustment mode.
14. Take the probe out of the reference conditions and replace the filter.

Relative Humidity Adjustment after Sensor Change

Using Display/Keypad

When using the optional display/keypad, follow the instructions on Using Display/Keypad on page 142 but select **Adj. for new RH sensor (**instead of **1-point**/ **2-point adjustment)**.

Using Serial Line

After sensor change, carry out the procedure as described in previous sections. Just replace the **CRH** command with the **FCRH** command.

FCRH

Example:

```
>FCRH
RH   :    1.82 1. ref    ?    0
Press any key when ready...
RH   :    74.22    2. ref    ? 75
OK
>
```

The OK indicates that the calibration has succeeded.

Temperature Adjustment

Using Display/Keypad

1. Press the **ADJ** button on the motherboard to open the **ADJUSTMENT MENU**. If using a warmed probe for measuring, probe heating will be interrupted when **ADJ** key is pressed. Wait some time for the probe to reach ambient temperature.
2. Select ►**Adjust T measurement**, press ►key.
3. Select **1-point/ 2-point adjustment**, press. Press **START**.
4. Remove the filter from the probe and insert the probe into the reference temperature.
5. Wait at least 30 minutes for the sensor to stabilize. Follow the stabilization from the **GRAPH** display.
6. Press **READY** when stabilized. Give the reference temperature by using the arrow buttons.

   When carrying out the 2-point adjustment proceed to the next adjustment point and carry out the procedure as described in the previous item. Please, note that the difference between the two temperature references must be at least 30 ºC.
7. Press **OK.** Press **YES** to confirm the adjustment.
8. Press **OK** to return to the adjustment menu.
9. Press **EXIT** to close the adjustment mode and return to the basic display.

Using Serial Line

1. Press the **ADJ** key on the motherboard to open the adjustment mode. If using a warmed probe for measuring, probe heating will be interrupted when **ADJ** key is pressed. Wait some time for the probe to reach ambient temperature.
2. Remove the probe filter and insert the probe into the reference temperature.
3. Enter the command **CT** or (**CTA** for additional T probe) and press **ENTER**.

   CT

   or for additional T probe:

   CTA
4. Type **C** and press **ENTER** a few times to check if the reading is stabilized. Let the reading stabilize, give the reference temperature after the question mark and press **ENTER** three times**.**

   When using two reference temperatures (2-point calibration) press **ENTER** only twice and insert the probe to the second reference. When the reading is stabilized, give the second reference temperature after the question mark and press **ENTER**. Please, note that the difference between the two temperature references must be at least 30 ºC.

   Example (1-point adjustment):

```
>ct
T   :    16.06  Ref1 ? c
T   :    16.06  Ref1 ? c
T   :    16.06  Ref1 ? c
T   :    16.06  Ref1 ? c
T   :    16.06  Ref1 ? c
T   :    16.06  Ref1 ? 16.0
Press any key when ready ...
T   :    16.06  Ref2 ?
OK
>
```

5. **OK** indicates that the calibration has succeeded. Enter the calibration information (date and text) to the transmitter's memory; see the serial commands **CTEXT** and **CDATE**.
6. Press the **ADJ** button on the motherboard to close the adjustment mode.

7. Take the probe out of the reference conditions and replace the filter.

Analog Output Adjustment

In the analog output calibration the analog output is forced to the following values:

- Current output: 2 mA and 18 mA

- Voltage output: 10 % and 90 % of the range

Connect HMT330 to a calibrated current/voltage meter in order to measure either current or voltage depending on the selected output type.

Using Display/Keypad

1. Press the **ADJ** button to open the **ADJUSTMENT MENU**.
2. Select **Adjust analog outputs**, press ► button.
3. Select the output to be adjusted Adjust **analog output 1/2**, press **START**.
4. Measure the first analog output value with a multimeter. Give the measured value by using the arrow buttons. Press **OK.**
5. Measure the second analog output value with a multimeter. Give the measured value by using the arrow buttons. Press **OK.**
6. Press **OK** to return to the adjustment menu.
7. Press **EXIT** to close the adjustment mode and to return to the basic display.

Using Serial Line

Enter the **ACAL** command and type the multimeter reading for each case. Continue by pressing **ENTER**.

ACAL

Example (current outputs):

```
>ACAL
Ch1  I1   (mA) ?    2.046
Ch1  I2   (mA) ?    18.087
```

```
Ch2  I1   (mA) ?    2.036
Ch2  I2   (mA) ?    18.071
>
```

Feeding Adjustment Information

This information is shown on the device information fields (see section Device Information on page 101.)

Using Display/Keypad

1. If you are not in the adjustment menu, press the **ADJ** button on the motherboard (opens the **ADJUSTMENT MENU**).
2. Select **Adjustment info,** press the ► button.
3. Select **Date**, press **SET**. Give the date by using the arrow buttons. Press **OK**.
4. Select **i,** press **SET.** Enter information text including 17 characters at maximum by using the arrow buttons. Press **OK.**
5. Press **EXIT** to return to the basic display.

Using Serial Line

CTEXT

Use the CTEXT command to enter text to the adjustment information field.

Example:

```
>ctext
Adjust. info   : (not set) ? HMK15
>
```

CDATE

Use the CDATE command to enter date to adjustment information field. Set the adjustment date in format YYYY-MM-DD.

Example.

```
>cdate
Adjust. date   : (not set) ? 2004-05-21
>
```

CHAPTER 7

TECHNICAL DATA

This chapter provides the technical data of the product.

Specifications

Performance

Relative Humidity

Measurement range		0 ... 100 %RH
Accuracy (including non-linearity, hysteresis and repeatability)		
with	HUMICAP®180	for typical applications
	HUMICAP®180R	for typical applications
	HUMICAP®180C	for applications with chemical purge and/or warmed probe
	HUMICAP®180RC	for applications with chemical purge and/or warmed probe
	at +15 ... 25 °C	± 1 % RH (0 ... 90 % RH) ± 1.7 % RH (90 ... 100 %RH)
	at -20 ... +40 °C	± (1.0 + 0.008 × reading) % RH
	at -40 ... + 180 °C	± (1.5 + 0.015 × reading) % RH
with	HUMICAP®180L2	for applications with demanding chemical environment
	at -10 ... +40 °C	± (1.0 + 0.01 × reading) % RH
	at -40 ... +180 °C	± (1.5 + 0.02 × reading) % RH
Factory calibration uncertainty (+20 °C)		±0.6 % RH (0 ... 40 % RH) ±1.0 % RH (40 ... 97 % RH) (Defined as ± 2 standard deviation limits. Small variations possible, see also calibration certificate.)

Response time (90 %) for HUMICAP®180, HUMICAP®180C and HUMICAP®180L2 at 20 °C in still air

8 s with grid filter
20 s with grid + steel netting filter
40 s with sintered filter

Response time (90 %) for HUMICAP®180R and HUMICAP®180RC at 20 °C in 0.1 m/s air flow

17 s with grid filter
50 s with grid + steel netting filter
60 s with sintered filter

Temperature (+ Operating Pressure Ranges)

HMT331	-40 ... +60 °C (-40 ... +140 °F)
HMT333 80 ºC	-40 ... +80 °C (-40 ... +176 °F)
HMT333 120 ºC	-40 ... +120 °C (-40 ... +248 °F)
HMT334	-70 ... +180 °C (-94 ... +356 °F), 0 ... 10 MPa (0 ... 100 bar)
HMT335 (vapor tight)	-70 ... +180 °C (-94 ... +356 °F)
HMT337 (vapor tight)	-70 ... +180 °C (-94 ... +356 °F)
HMT338	-70 ... +180 °C (-94 ... +356 °F), 0 ... 4 MPa (0 ... 40 bar)

Accuracy at +20 °C (+68 °F) ± 0.2 °C
Accuracy over temperature range (see graph below):

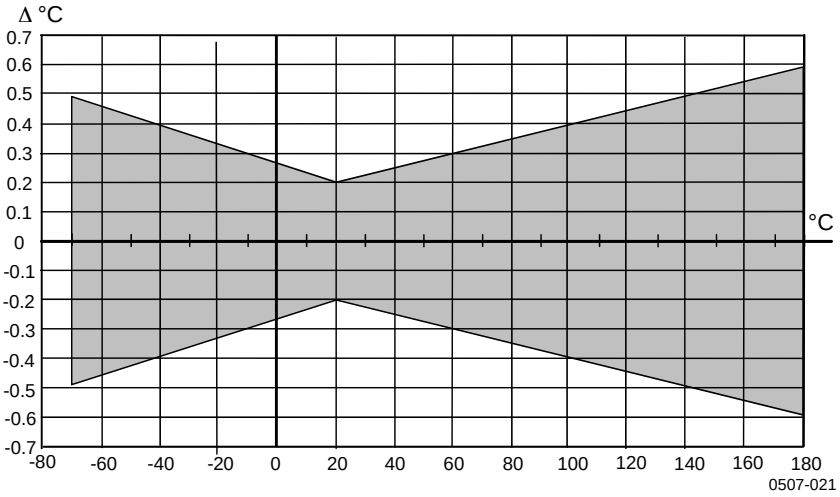


Figure 71 Accuracy over Temperature Range

Temperature sensor Pt 100 RTD 1/3 Class B IEC 751

Optional Temperature Probe

Temperature measurement range:	-70 ... + 180 ºC (-94 ... +356 ºF)
Typical accuracy:	0.1 ºC (0.18 ºF)
Sensor:	Pt100 PRT DIN IEC 751 class 1/4 B
Cable length:	2 m, 5 m, and 10 m
Pressure tight:	up to 7 bar
Probe material:	stainless steel

Calculated Variables

Table 30 Calculated Variables (Typical Ranges)

Variable	HMT331 probe	HMT333 probe	HMT334/335/337/338 probes
Dewpoint temperature	-20 ... +60 ºC	-20 ... +80 ºC	-20 ... +100 ºC
Mixing ratio	0 ... 160 g/kg dry air	0 ... 500 g/kg dry air	0 ... 500 g/kg dry air
Absolute humidity	0 ... 160 g/m^3	0 ... 500 g/m^3	0 ... 500 g/m^3
Wet bulb temperature	0 ... 60 ºC	0 ... +100 ºC	0 ... +100 ºC
Enthalpy	-40 ... +1500 kJ/kg	-40 ... +1500 kJ/kg	-40 ... +1500 kJ/kg
Water vapor pressure	0 ... 1000 hPa	0 ... 1000 hPa	0 ... 1000 hPa

Accuracies of Calculated Variables

Accuracies of the calculated variables depend on the calibration accuracy of the humidity and temperature sensors; here the accuracies are given for ± 2 %RH and ± 0.2 °C.

Accuracy of Dewpoint Temperature °C

	Relative humidity									
Temp.	10	20	30	40	50	60	70	80	90	100
-40	1.86	1.03	0.76	0.63	0.55	0.50	0.46	0.43	—	—
-20	2.18	1.19	0.88	0.72	0.62	0.56	0.51	0.48	—	—
0	2.51	1.37	1.00	0.81	0.70	0.63	0.57	0.53	0.50	0.48
20	2.87	1.56	1.13	0.92	0.79	0.70	0.64	0.59	0.55	0.53
40	3.24	1.76	1.27	1.03	0.88	0.78	0.71	0.65	0.61	0.58
60	3.60	1.96	1.42	1.14	0.97	0.86	0.78	0.72	0.67	0.64
80	4.01	2.18	1.58	1.27	1.08	0.95	0.86	0.79	0.74	0.70
100	4.42	2.41	1.74	1.40	1.19	1.05	0.95	0.87	0.81	0.76
120	4.86	2.66	1.92	1.54	1.31	1.16	1.04	0.96	0.89	0.84
140	5.31	2.91	2.10	1.69	1.44	1.26	1.14	1.05	0.97	0.91
160	5.80	3.18	2.30	1.85	1.57	1.38	1.24	1.14	1.06	0.99

Accuracy of Mixing Ratio g/kg (Ambient Pressure 1013 mbar)

	Relative humidity									
Temp.	10	20	30	40	50	60	70	80	90	100
-40	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.004	—	—
-20	0.017	0.018	0.019	0.021	0.022	0.023	0.025	0.026	—	—
0	0.08	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.13	0.13
20	0.31	0.33	0.35	0.37	0.39	0.41	0.43	0.45	0.47	0.49
40	0.97	1.03	1.10	1.17	1.24	1.31	1.38	1.46	1.54	1.62
60	2.68	2.91	3.16	3.43	3.72	4.04	4.38	4.75	5.15	5.58
80	6.73	7.73	8.92	10.34	12.05	14.14	16.71	19.92	24.01	29.29
100	16.26	21.34	28.89	40.75	60.86	98.85	183.66	438.56	—	—
120	40.83	74.66	172.36	—	—	—	—	—	—	—

Accuracy of Wet Bulb Temperature °C

	Relative humidity									
Temp.	10	20	30	40	50	60	70	80	90	100
-40	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	—	—
-20	0.21	0.21	0.22	0.22	0.22	0.22	0.23	0.23	—	—
0	0.27	0.28	0.28	0.29	0.29	0.29	0.30	0.30	0.31	0.31
20	0.45	0.45	0.45	0.44	0.44	0.44	0.43	0.43	0.42	0.42
40	0.84	0.77	0.72	0.67	0.64	0.61	0.58	0.56	0.54	0.52
60	1.45	1.20	1.03	0.91	0.83	0.76	0.71	0.67	0.63	0.60
80	2.23	1.64	1.32	1.13	0.99	0.89	0.82	0.76	0.72	0.68
100	3.06	2.04	1.58	1.31	1.14	1.01	0.92	0.85	0.80	0.75
120	3.85	2.40	1.81	1.48	1.28	1.13	1.03	0.95	0.88	0.83
140	4.57	2.73	2.03	1.65	1.41	1.25	1.13	1.04	0.97	0.91
160	5.25	3.06	2.25	1.82	1.55	1.37	1.24	1.13	1.05	0.99

Accuracy of Absolute Humidity g/m³

	Relative humidity									
Temp.	10	20	30	40	50	60	70	80	90	100
-40	0.004	0.004	0.005	0.005	0.005	0.006	0.006	0.006	—	—
-20	0.023	0.025	0.027	0.029	0.031	0.032	0.034	0.036	—	—
0	0.10	0.11	0.12	0.13	0.13	0.14	0.15	0.15	0.16	0.17
20	0.37	0.39	0.41	0.43	0.45	0.47	0.49	0.51	0.53	0.55
40	1.08	1.13	1.18	1.24	1.29	1.34	1.39	1.44	1.49	1.54
60	2.73	2.84	2.95	3.07	3.18	3.29	3.40	3.52	3.63	3.74
80	6.08	6.30	6.51	6.73	6.95	7.17	7.39	7.61	7.83	8.05
100	12.2	12.6	13.0	13.4	13.8	14.2	14.6	15.0	15.3	15.7
120	22.6	23.3	23.9	24.6	25.2	25.8	26.5	27.1	27.8	28.4
140	39.1	40.0	41.0	42.0	43.0	44.0	45.0	45.9	46.9	47.9
160	63.5	64.9	66.4	67.8	69.2	70.7	72.1	73.5	74.9	76.4

Dewpoint Temperature (HMT337 Warmed Probe Option)

Find the intersection of the dewpoint temperature curve and the dewpoint difference reading (process temperature-dewpoint temperature) on the x-axis and read the accuracy in dewpoint measurement on the y-axis.

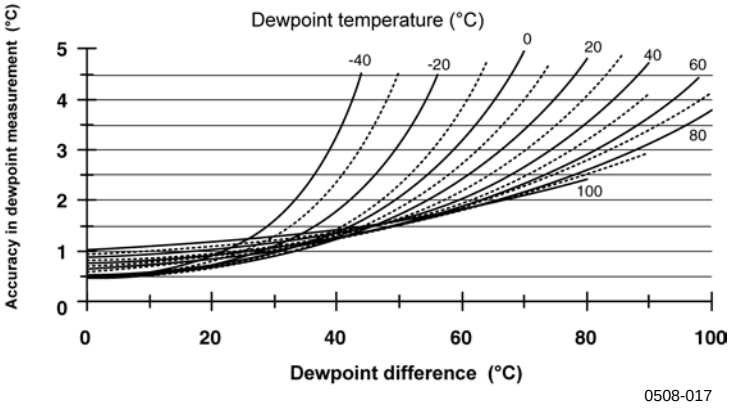


Figure 72 Accuracy in Dewpoint Measurement

Operating Environment

Operating temperature range	
for humidity measurement	-70 ... +180 °C (-94 ... +356 °F) see probe specifications
for transmitter body electronics	-40 ... +60 °C (40 ... +140 °F)
with display	0 ... +60 °C (+32 ... +140 °F)
Storage temperature	-55 … +80 °C (-67 … +176 °F)
Electromagnetic compatibility	EN61326-1:1997+ Am1:1998 + Am2:2001 Industrial environment

Inputs and Outputs

Operating voltage	10 ... 35 VDC, 24 VAC
with optional power supply module	100 ... 240 VAC, 50/60 Hz
Start-up time after power-up	3 s
Power consumption @ 20 °C (Uin 24VDC)	
RS-232	max 25 mA
Uout 2 × 0 ... 1V / 0 ... 5V / 0 ... 10V	max 25 mA
Iout 2 × 0 ... 20 mA	max 60 mA
display and backlight	+ 20 mA
during sensor purge	+ 110 mA max
Analog outputs (2 standard, 3rd optional)	
current output	0 ... 20 mA, 4 ... 20 mA
voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Accuracy of analog outputs at 20 °C	± 0.05 % full scale
Temperature dependence of the analog outputs	± 0.005 %/°C full scale
External loads	
current outputs	RL < 500 ohm
0 ... 1V output	RL > 2 kohm
0 ... 5V and 0 ... 10V outputs	RL > 10 kohm
Max wire size	0.5 mm2 (AWG 20) stranded wires recommended
Digital outputs	RS-232, RS-485 (optional)
Relay outputs (optional)	0.5 A, 250 VAC, SPDT
Display (optional)	LCD with backlight, graphic trend display
Menu languages	English, French, Spanish, German, Japanese, Russian, Swedish, Finnish, Chinese.

Mechanics

Cable bushing	M20x1.5 for cable diameter 8 ... 11mm/0.31..0.43"
Conduit fitting	1/2"NPT
User cable connector (optional)	M12 series 8- pin (male)
option 1	with plug (female) with 5 m / 16.4 ft black cable
option 2	with plug (female) with screw terminals
Probe cable diameter	
HMT333 80ºC	6.0 mm
Other probes	5.5 mm
Probe cable lengths	2 m, 5 m or 10 m
Probe tube material	
HMT331	Chromed ABS plastic
Other probes	AISI 316L
Housing material	G-AlSi 10 Mg (DIN 1725)
Housing classification	IP 65 (NEMA 4)

Transmitter Weight

Table 31 Transmitter Weight (in kg/lb)

Probe Type	Probe Cable Length		
	2 m	5 m	10 m
HMT333	1.1/2.4	1.2/2.6	1.5/3.3
HMT334	1.4/3.1	1.6/3.5	1.9/4.2
HMT335	1.3/2.9	1.4/3.1	1.7/3.7
HMT337	1.2/2.6	1.3/2.9	1.5/3.3
HMT338 178 mm	1.3/2.9	1.5/3.3	1.7/3.7
HMT338 400 mm	1.4/3.1	1.6/3.5	1.9/4.2

Technical Specifications of Optional Modules

Power Supply Module

Operating voltage	100 ... 240 VAC 50/60 Hz
Connections	screw terminals for 0.5 ... 2.5 mm^2 wire (AWG 20 ... 14)
Bushing	for 8 ... 11 mm diameter cable
Operating temperature	-40 ... +60 °C (-40 ... +140 °F)
Storage temperature	-40 ... +70°C (-40 ... +158 °F)

Analog Output Module

Outputs	0 ... 20 mA, 4 ... 20 mA, 0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Operating temperature range	-40 ... +60 °C (-40 ... +140 ºF)
Power consumption	
U_{out} 0 ... 1 V	max 30 mA
U_{out} 0 ... 5V/0 ... 10V	max 30 mA
I_{out} 0 ... 20 mA	max 60 mA
External loads	
current outputs	R_L< 500 ohms
Max load + cable loop resistance	540 ohms
0 ... .1 V	R_L> 2000 ohms
0 ... 5 V and 0 ... 10 V	R_L> 10 000 ohms
Storage temperature range	-55 ... +80 °C (-67 ... +176 ºF)
3-pole screw terminal	
Max wire size	1.5 mm^2 (AWG16)

Relay Module

Operating temperature range	-40 ... +60 ºC (-40 ... +140 ºF)
Operating pressure range	500 ... 1300 mmHg
Power consumption @ 24 V	max 30 mA
Contacts SPDT (change over), for example,	
Contact arrangement Form C	
Imax	0.5 A 250 VAC
Imax	0.5 A 30 VDC
Safety standard for the relay component	IEC60950 UL1950
Storage temperature range	-55 ... +80 ºC (-67 ... +176 ºF)
3-pole screw terminal / relay	
Max wire size	2.5 mm2 (AWG14)

RS-485 Module

Operating temperature range	-40 ... +60 ºC (-40 ... +140 ºF)
Operating modes	2-wire (1-pair) half duplex 4-wire (2-pair) full duplex
Operating speed max	115.2 kbaud
Bus isolation	300VDC
Power consumption @ 24V	max 50 mA
External loads	
standard loads	32 RL> 10kohm
Storage temperature range	-55 ... +80 ºC (-67 ... +176 ºF)
Max wire size	1.5 mm2 (AWG16)

LAN Interface Module

Operating temperature range	-40 ... +60 ºC (-40 ... +140 ºF)
Storage temperature range	-40 ... +85 ºC (-40 ... +185 ºF)
Operating humidity range	5 … 95 %RH
Power consumption @ 24V	max 60 mA
Ethernet type	10/100Base-T
Connector	RJ45
Supported protocols	Telnet, HTTP

WLAN Interface Module

Operating temperature range	-20 ... +60 ºC (-4 ... +140 ºF)
Storage temperature range	-40 ... +85 ºC (-40 ... +185 ºF)
Operating humidity range	5 … 95 %RH
Power consumption @ 24V	max 80 mA
Connector	RP-SMA
Supported protocols	Telnet, HTTP
Security	WEP 64/128,WPA

Data Logger Module

Operating temperature range	-40 ... +60 ºC (-40 ... +140 ºF)
Storage temperature range	-55 ... +80 ºC (-67 ... +176 ºF)
Power consumption @ 24V	max 10 mA
Logged parameters	up to three with trend/min/max values for each
Logging interval	10 s (fixed)
Maximum logging period	4 years 5 months
Logged points	13.7 million points / parameter
Accuracy of the clock	better than ±2 min/year
Battery lifetime	
at -40 ... +30 ºC (-40 ... +86 ºF)	7 years
at +30 ... +60 ºC (+86 ... +140 ºF)	5 years

Options and Accessories

Description	Item code
MODULES	
Relay Module	RELAY-1
Analog Output Module	AOUT-1
Isolated RS485 Module	RS485-1
Power Supply Module	POWER-1
Galvanic Isolation Module	DCDC-1
SENSORS	
HUMICAP180	HUMICAP180
HUMICAP180L2	HUMICAP180L2
HUMICAP180R	HUMICAP180R
PT100 Sensor	10429SP
FILTERS	
PPS Plastic Grid with Stainless Steel Netting	DRW010281SP
PPS Plastic Grid Filter	DRW010276SP
Sintered Filter AISI 316L	HM47280SP
Stainless Steel Filter	HM47453SP
Stainless Steel Filter with Membrane	214848SP
TRANSMITTER MOUNTING ACCESSORIES	
Wall Mounting Kit	214829
Installation Kit for Pole or Pipeline	215108
Rain Shield with Installation Kit	215109
DIN Rail Clips with Installation Plate	215094
Meteorological Installation Kit	HMT330MIK
Panel Mounting Frame	216038
PROBE MOUNTING ACCESSORIES	
HMT334	
Fitting Body M22x1.5	17223SP
Fitting Body NPT1/2	17225SP
HMT335	
Mounting Flange For HMT335	210696
HMT337	
Swagelok for 12mm Probe 3/8" ISO Thread	SWG12ISO38
Swagelok for 12mm Probe 1/2" ISO Thread	SWG12ISO12
Swagelok for 12mm Probe 1/2" NPT Thread	SWG12NPT12
Swagelok for 6mm Probe 1/2" ISO Thread	SWG6ISO12
Swagelok for 6mm Probe 1/8" ISO Thread	SWG6ISO18
Swagelok for 6mm Probe 1/8" NPT Thread	SWG6NPT18
Cable Gland M20x1.5 with Split Seal	HMP247CG
Duct Installation Kit for HMT333 and HMT337	210697

Description	Item code
Duct Installation Kit for Temperature Probe	215003
HMT338	
Ball Valve ISO1/2 with Welding Joint	BALLVALVE-1
Fitting Body ISO1/2 Solid Structure	DRW212076SP
Fitting Body NPT1/2 Solid Structure	NPTFITBODASP
Thread Adapter ISO1/2 to NPT1/2	210662SP
Manual Press	HM36854SP
Plug Kit (ISO 1/2)	218773
CONNECTION CABLES	
Serial Interface Cable	19446ZZ
USB-RJ45 Serial Interface Cable	219685
MI70 Connection Cable with RJ45 Connector	211339
HMI41 Connection Cable with RJ45 Connector	25917ZZ
OUTPUT CABLES FOR 8-PIN CONNECTOR	
Connection Cable 5m 8-pin M12 Female, Black	212142
Female Connector 8-pin M12 with Screw Terminals	212416
Male Connector 8-pin M12 with Cable and Adapter	214806SP
CABLE BUSHINGS	
Cable Gland M20x1.5 for 8 ... 11mm Cable	214728SP
Cable Gland M20x1.5 for 11 ... 14mm Cable	214729
Cable Gland M16x1.5 for Wall Mounting Plate Pass-Through	216681SP
Conduit Fitting M20x1.5 for NPT1/2 Conduit	214780SP
Dummy Plug M20x1.5	214672SP
WINDOWS SOFTWARE	
Software Interface Kit	215005
OTHER	
HMK15 Calibration Adapter for 12 mm Probes with >7 mm Sensor Pins	211302SP
HMK15 Calibration Adapter for 12 mm Probes with <3 mm Sensor Pins	218377SP

Dimensions (mm/inch)

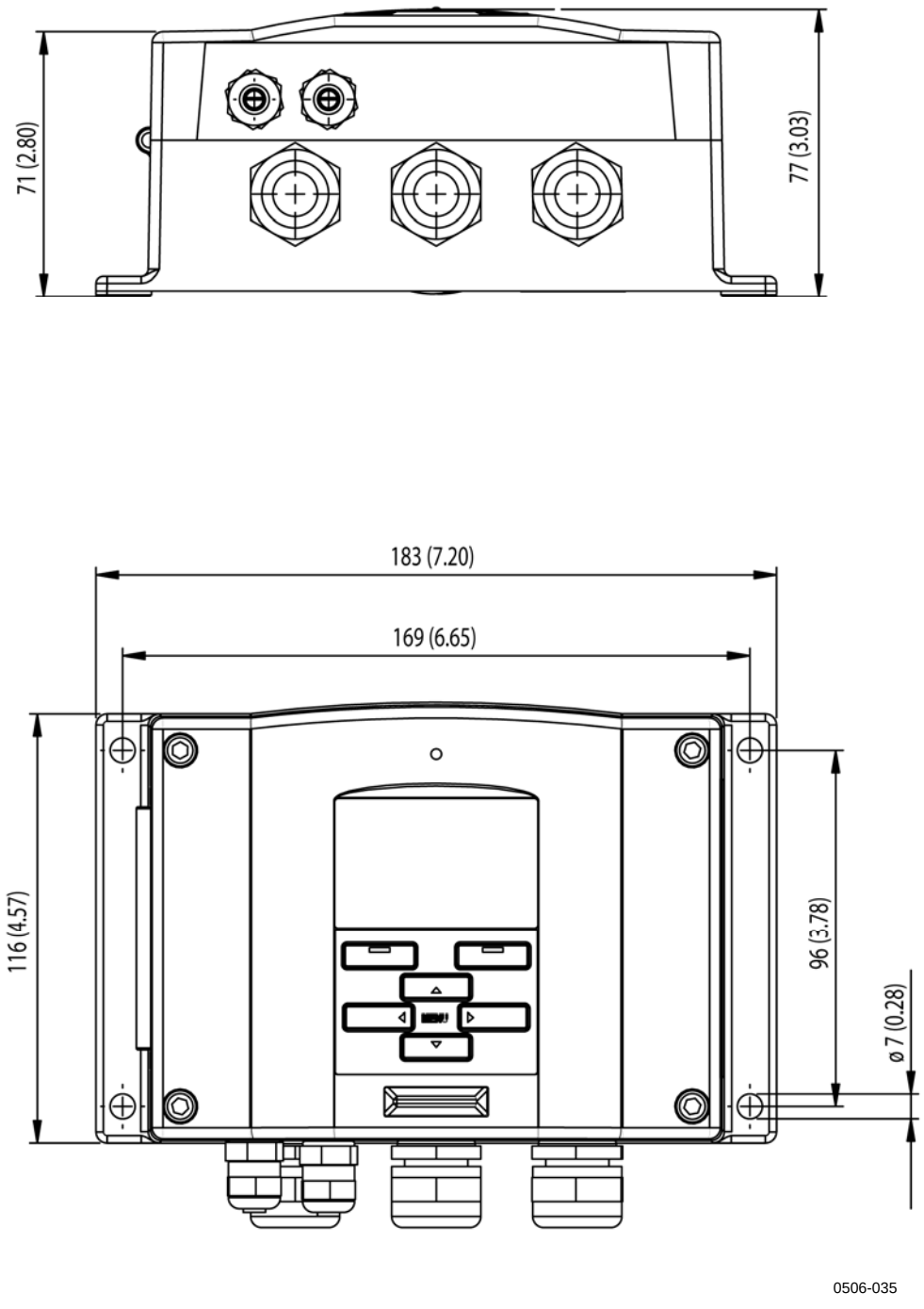


Figure 73 Transmitter Body Dimensions

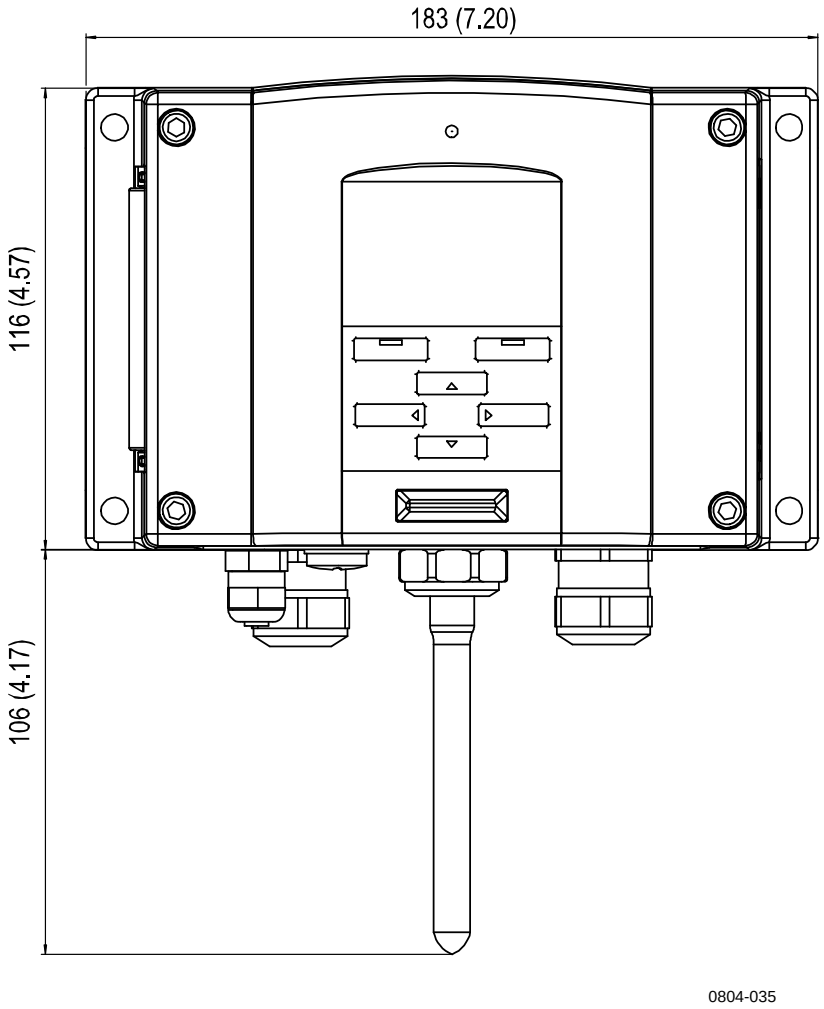


Figure 74 WLAN Antenna Dimensions

HMT331

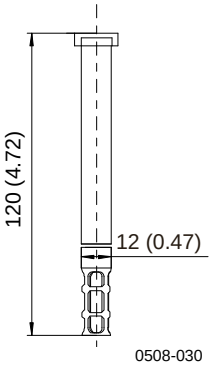


Figure 75 HMT331 Probe Dimensions

HMT333

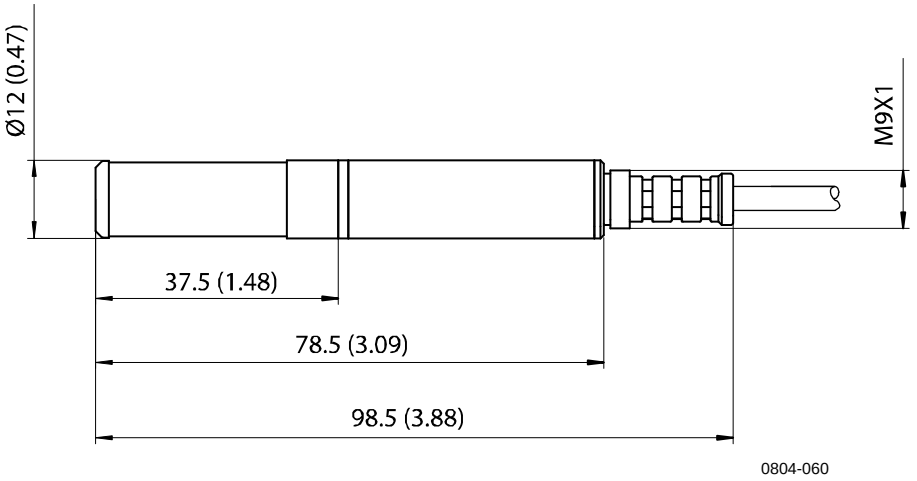


Figure 76 HMT333 Probe Dimensions

HMT334

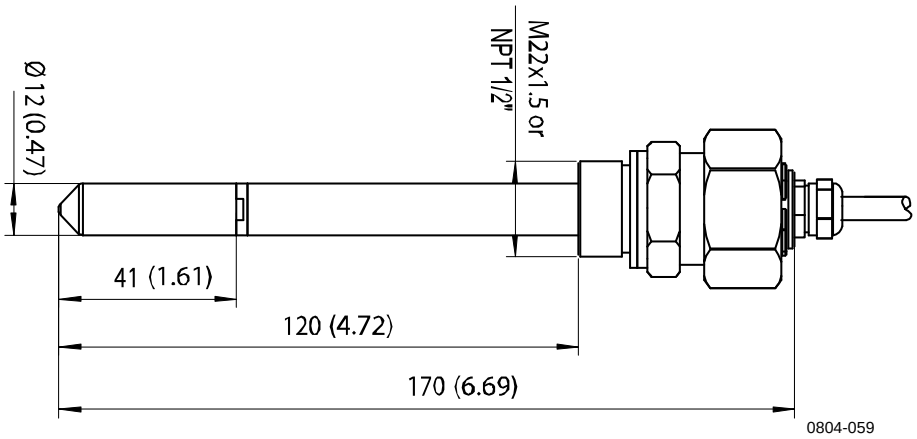


Figure 77 HMT334 Probe Dimensions

HMT335

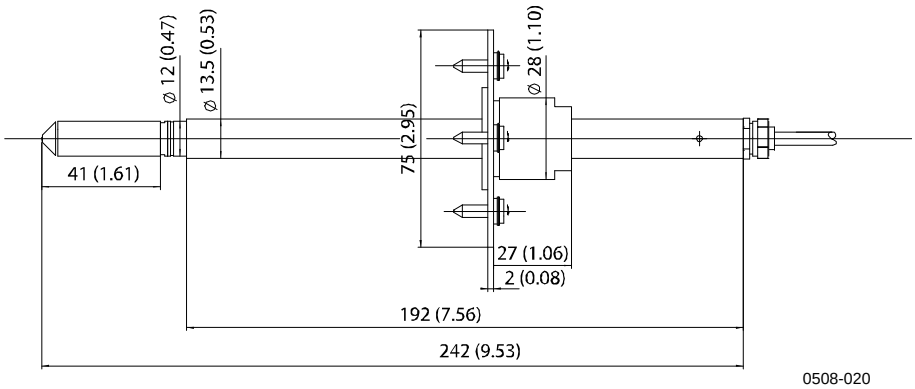


Figure 78 HMT335 Probe Dimensions

The flange is available as an option for the HMT335 probe.

HMT337

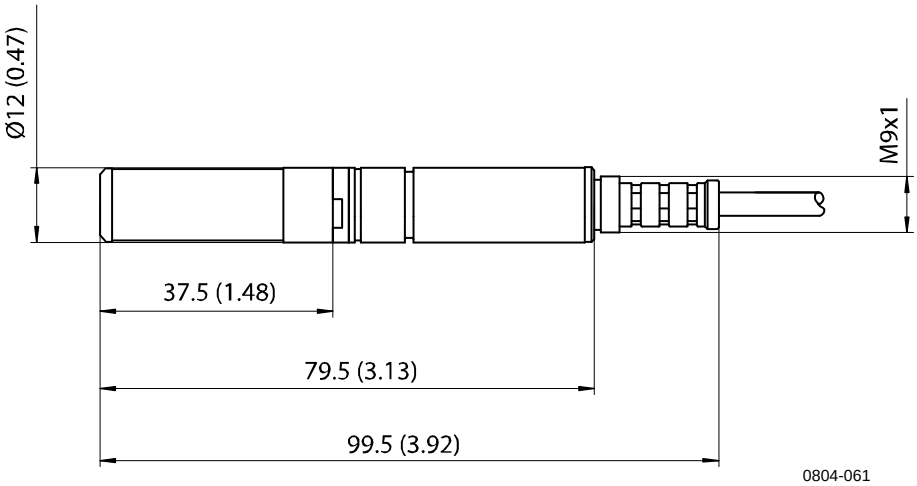


Figure 79 HMT337 Probe Dimensions

HMT338

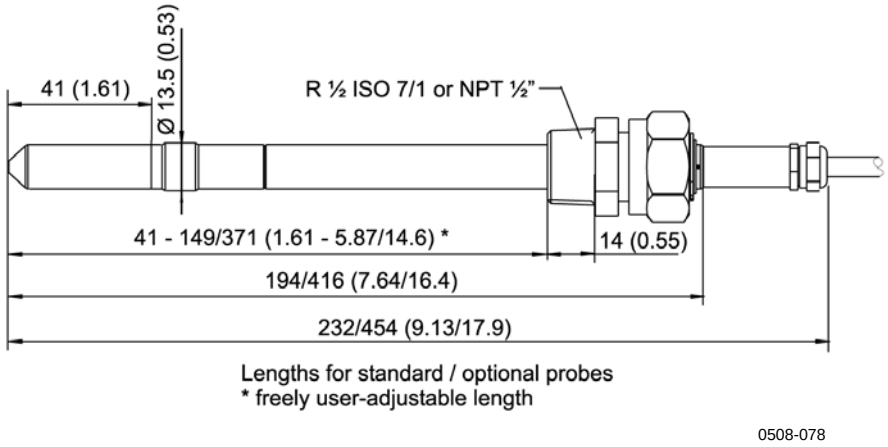


Figure 80 HMT338 Probe Dimensions

Temperature Probe

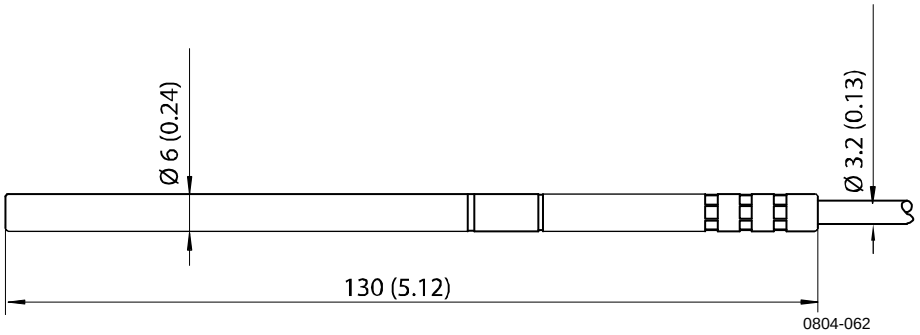


Figure 81 Optional Temperature Probe Dimensions

APPENDIX A

PROBE INSTALLATION KITS AND INSTALLATION EXAMPLES

Duct Installation Kits (for HMT333/337/335)

Duct installation kit includes a flange, a sealing ring, a supporting bar, a probe attaching part, and screws for attaching the flange to the duct wall. Vaisala order codes: 210697 (for HMT333 and HMT337), 210696 (for HMT335, no supporting bar), and 215003 for temperature probe.

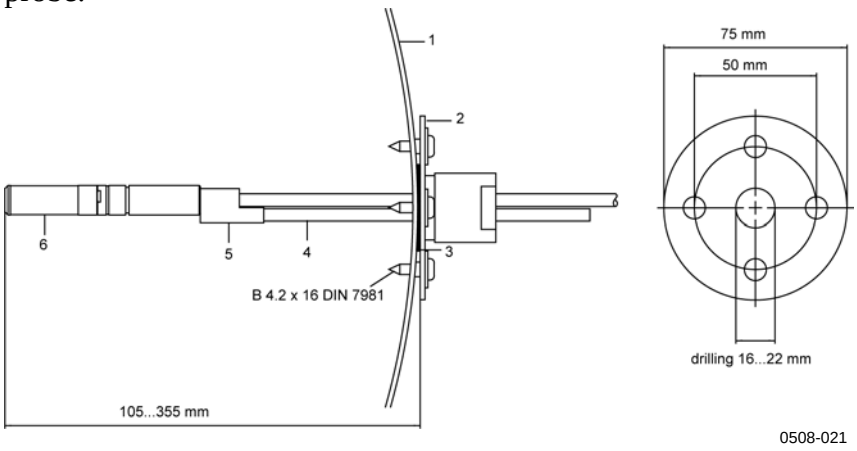


Figure 82 Duct Mounting Installation Kit

The following numbers refer to Figure 82:

1 = Duct wall
2 = Flange
3 = Sealing ring
4 = Supporting bar (not included in the kit for HMT335)
5 = Probe attaching part (to be fixed with the supporting bar)
6 = Relative humidity probe

NOTE When the temperature difference between the duct and the air outside the duct is remarkable, the supporting bar must be installed as deep in the duct as possible. This prevents errors caused by the heat conduction in the bar and cable.

Duct Installation Kit for Temperature Probe (for HMT337)

Vaisala duct installation kit for the T-probe includes flange, supporting bar, probe attaching part, sealing ring and the fixing screws (4 pcs). Vaisala order code: 215003.

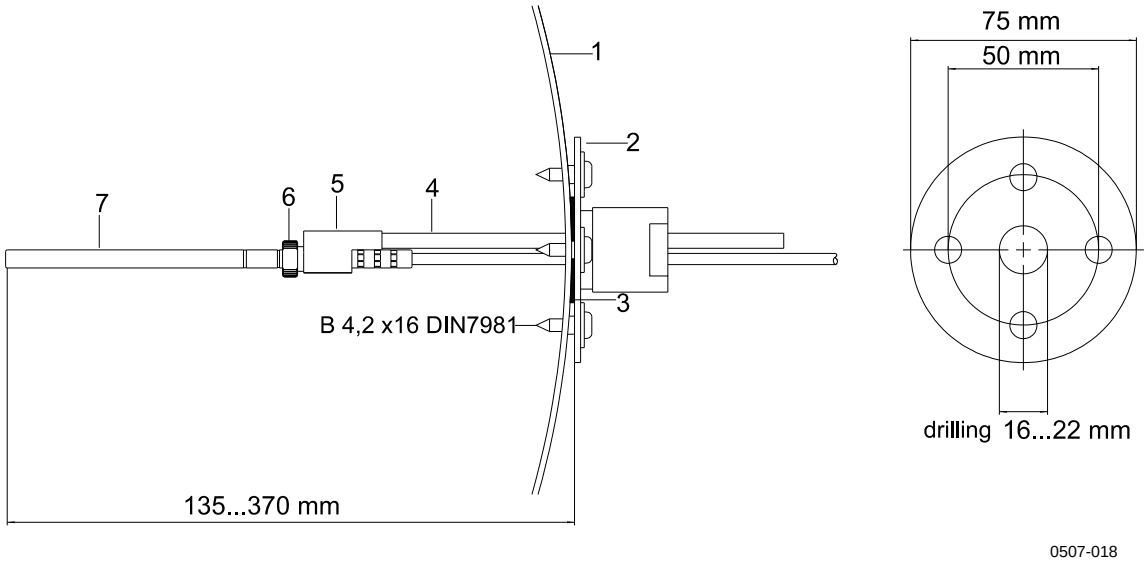


Figure 83 Duct Mounting Installation Kit for T-Probe

The following numbers refer to Figure 83:

1 = Duct wall
2 = Flange
3 = Sealing ring
4 = Supporting bar
5 = Probe support (to be fixed to the supporting bar)
6 = Retainer bushing (to be fixed to the probe support)
7 = Temperature probe (to be fixed to the retainer bushing)

Pressure Tight Swagelok Installation Kits (for HMT337)

RH Probe Installation

Swagelok installation kit for the relative humidity probe includes Swagelok connector with ISO3/8" or NPT1/2" thread. Vaisala order codes: SWG12ISO38 or SWG12NPT12.

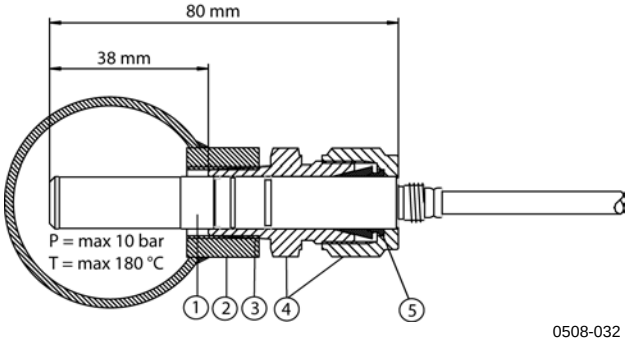


Figure 84 Swagelok Installation Kit for RH-probe

The following numbers refer to Figure 84:

1 = Relative humidity probe
2 = Duct connector
3 = ISO3/8" or NPT1/2" thread
4 = Swagelok connector
5 = Ferrules

Temperature Probe Installation

Swagelok installation kit for T-probe includes Swagelok connector with either ISO1/8" or NPT1/8" thread. Vaisala order codes: SWG6ISO18 or SWG6NPT18.

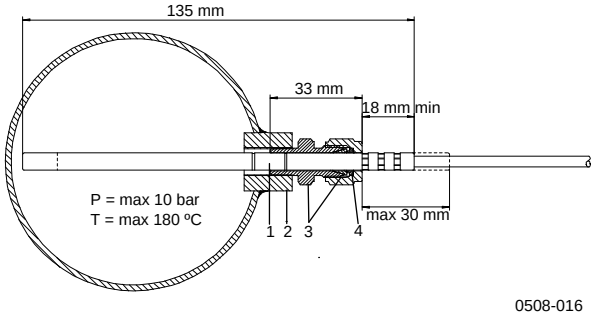


Figure 85 Swagelok Installation Kit for T-Probe

The following numbers refer to Figure 85:

1 = T-probe
2 = Duct connector
3 = Swagelok connector
4 = Ferrules

Examples of Vapor Tight Installations with Cable Gland

RH-Probe Installations (for HMT333/337)

Cable gland AGRO is available from Vaisala (order code: HMP247CG.)

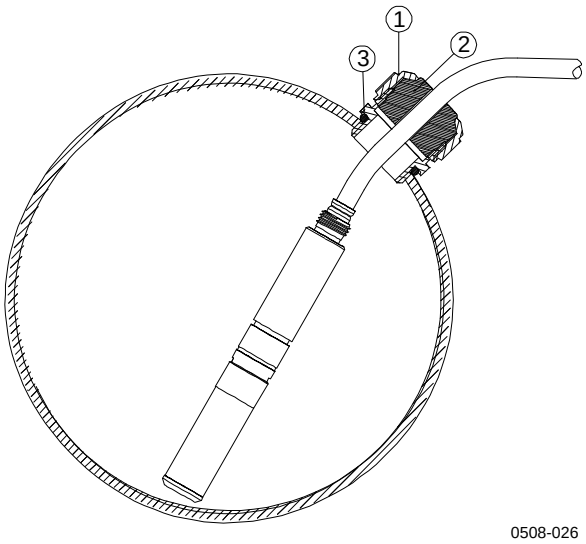


Figure 86 Cable Installation with Cable Gland

The following numbers refer to Figure 86:

1 = Nut (to be tightened to the body)
2 = Seal
3 = Body and O-ring

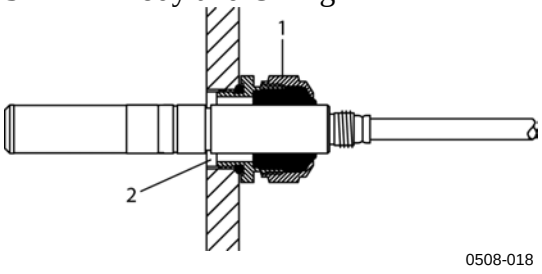


Figure 87 Probe Installation with Cable Gland

Probe installation with cable gland is not available from Vaisala.

The following numbers refer to Figure 87:

1 = AGRO 1160.20.145 (T= -40 ... +100 ºC) Not available from Vaisala.
2 = In pressurized places, use a locking ring (for example: 11× 1 DIN471).

T- Probe Installations (HMT337)

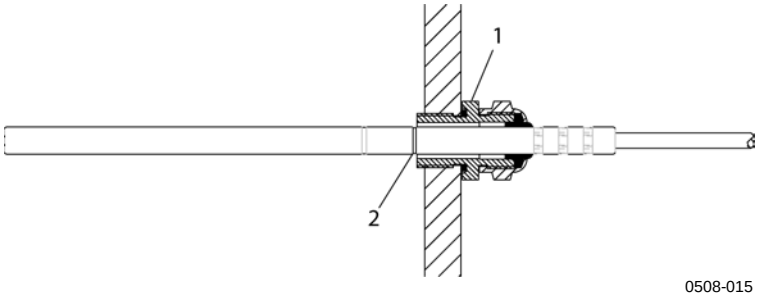


Figure 88 Vapor Tight Installation

Vapor Tight Installation is not available from Vaisala.

The following numbers refer to Figure 88:

1 = Cable gland. For example AGRO 1100.12.91.065 (T= -25 ... +200 ºC)
2 = In pressurized processes, use a locking ring (example: 6x 0.7 DIN471)

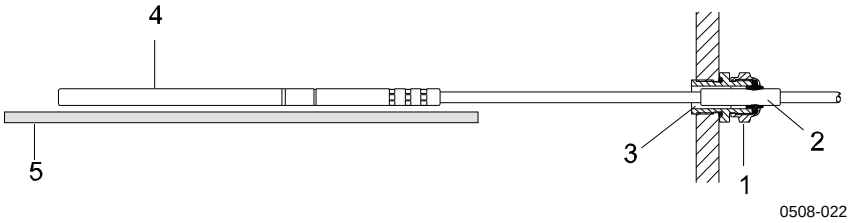


Figure 89 Wall Mounting Installation

Wall Mounting Installation is not available from Vaisala.

The following numbers refer to Figure 89:

1 = Cable gland. For example AGRO 1100.12.91.065
2 = Compacted PTFE sleeve
3 = Silicon glue between the PTFE sleeve and the cable
4 = Temperature probe
5 = Recommended support to keep the probe in horizontal position

Example of Climate Chamber Installation

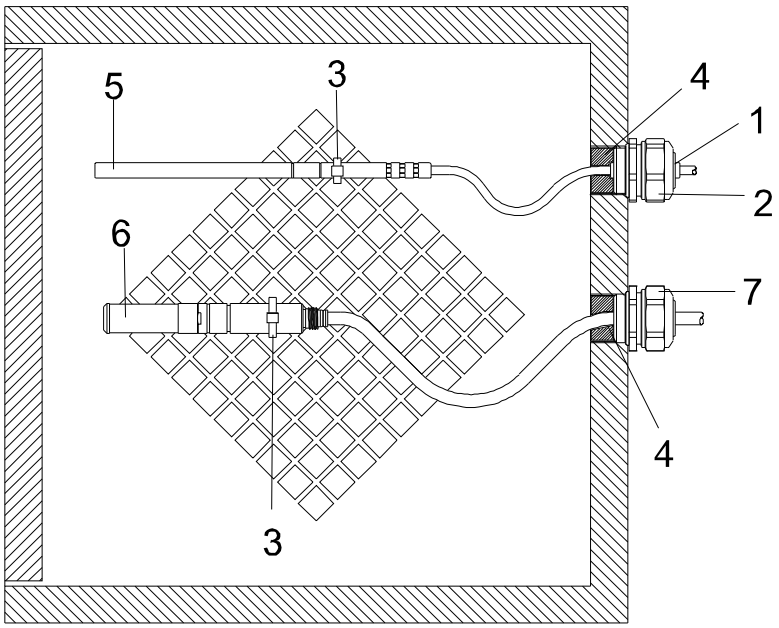


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Figure 90 Climate Chamber Installation (not Available from Vaisala)

The following numbers refer to Figure 90:

1 = PTFE sleeve
2 = Cable gland, for example: AGRO 1100.12.91.065
3 = Stainless steel cable tie or similar fastener[1]
4 = To be sealed (silicone)
5 = Temperature probe
6 = Relative humidity probe
7 = HMP247CG, Cable gland AGRO (available from Vaisala)

NOTE	Let the cables hang loosely to prevent condensed water running to the probe.

Example of Installation Through Roof

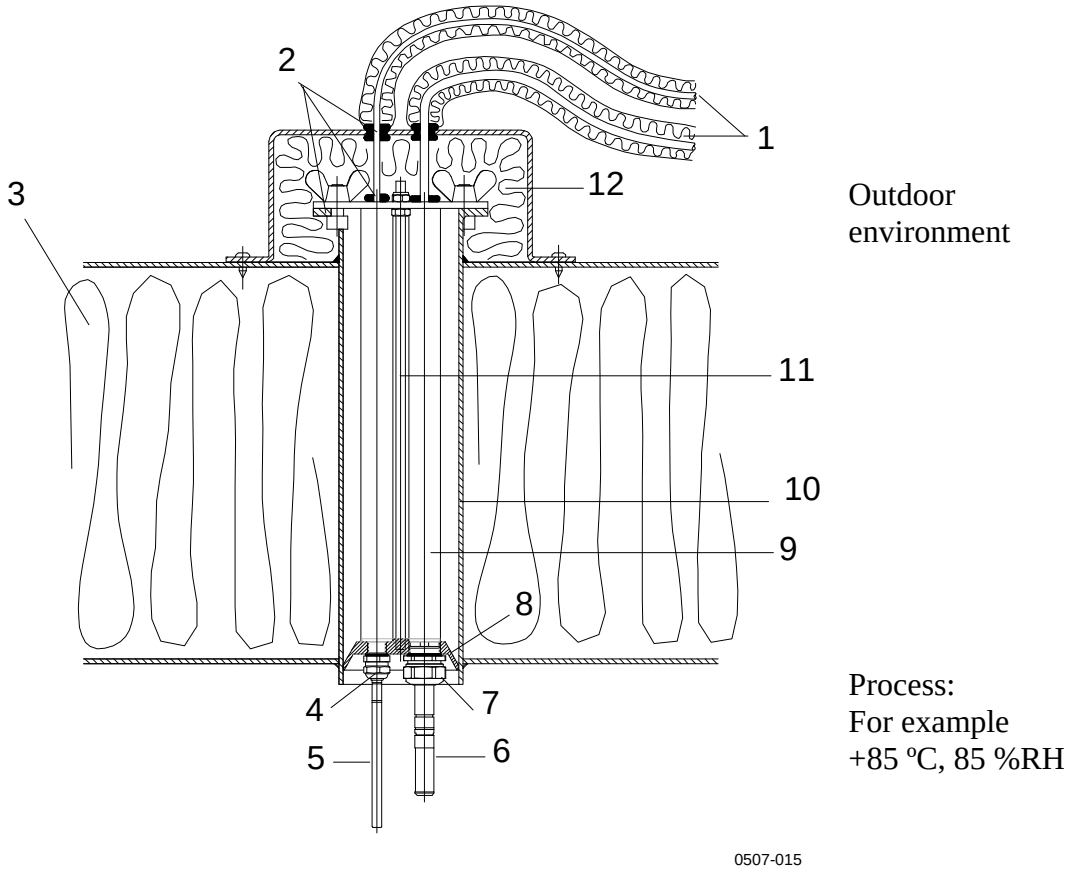

Figure 91 Example of Installation through Roof

The following numbers refer to Figure 91:

1 = Insulated probe cables
2 = Sealings
3 = Roof
4 = Cable gland for temperature probe (for example: AGRO 1100.12.91.065)
5 = Temperature probe
6 = Relative humidity probe
7 = Cable gland for relative humidity probe (for example: AGRO 1160.20.145)
8 = Plastic adapter to protect probes from condensation water coming from the pipe. Diameter slightly smaller than tube diameter.
9 = Plastic tube for probe (2 pcs)
10 = Stainless steel tube coming through the roof.
11 = Two thread bars holding the plastic adapter.
12 = Insulated pipe ending.

Ball Valve Installation Kit for HMT338

The ball valve installation kit (Vaisala order code: BALLVALVE-1) is preferred when connecting the probe to a pressurized process or pipeline. Use the ball valve set or a 1/2" ball valve assembly with a ball hole of ø14 mm or more. If you install the probe (ø12 mm) in a process pipe, please note that the nominal size of the pipe must be at least 1 inch (2.54 cm). Use the manual press handle to press the probe into the pressurized (< 10 bar) process or pipeline.

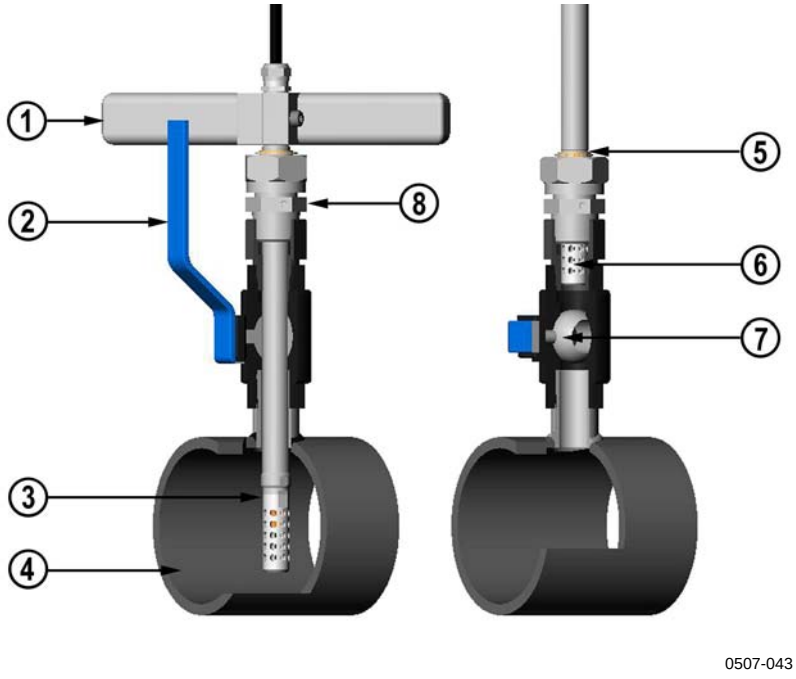

Figure 92 Installing the HMT338 Probe Through a Ball Valve Assembly

The following numbers refer to Figure 92:

1 = Manual press tool
2 = Handle of the ball valve
3 = Probe
4 = Process chamber or pipeline
5 = Groove on the probe indicates the upper adjustment limit
6 = Filter
7 = Ball of the ball valve
8 = Fitting screw

NOTE The probe can be installed in the process through the ball valve assembly provided that the process pressure is less than 10 bars. This way, the process does not have to be shut down when installing or removing the probe. However, if the process is shut down before removing the probe, the process pressure can be max. 20 bars.

NOTE When measuring temperature dependent quantities make sure that the temperature at the measurement point is equal to that of the process, otherwise the moisture reading may be incorrect.

Follow the steps below to install the HMT338 probe through a ball valve assembly. After the installation, the probe should be sitting in the process chamber or pipeline as shown in Figure 92 on page 172.

1. Shut down the process if the process pressure is more than 10 bars. If the pressure is lower there is no need to shut down the process.
2. Close the ball valve.
3. Seal the threads on the fitting body; refer to Figure 26 on page 43.
4. Attach the fitting body to the ball valve and tighten it.
5. Slide the clasp nut of the probe toward the filter, as far as it will go.
6. Insert the probe to the fitting body, and manually tighten the clasp nut to the fitting body.
7. Open the ball valve.
8. Push the probe through the ball valve assembly into the process. If the pressure is high, use the pressing handle that is provided with the probe. If you push the probe hard without using the handle, you may damage the cable.

   Note that the probe must be pushed so deep that the filter is completely inside the process flow.
9. Mark the fitting screw and the clasp nut.
10. Tighten the clasp nut with a fork spanner a further 50 ... 60º (ca. 1/6 turn). If you have a suitable torque spanner, tighten the nut to max 45 ± 5 Nm (33 ± 4 ft-lbs). Refer to Figure 27 on page 44.

NOTE	Take care not to tighten the clasp nut more than 60° to avoid difficulties when opening it.

If you wish to remove the probe from the process, note that you have to pull the probe out far enough. You cannot close the valve if the groove on the probe body is not visible.

Meteorological Installation Kit (for HMT337)

The Vaisala meteorological Installation Kit HMT330MIK (Vaisala order code: HMT330MIK) enables the HMT337 to be installed outdoors to obtain reliable measurements for meteorological purposes. For more information, see HMT330MIK brochure and order form.

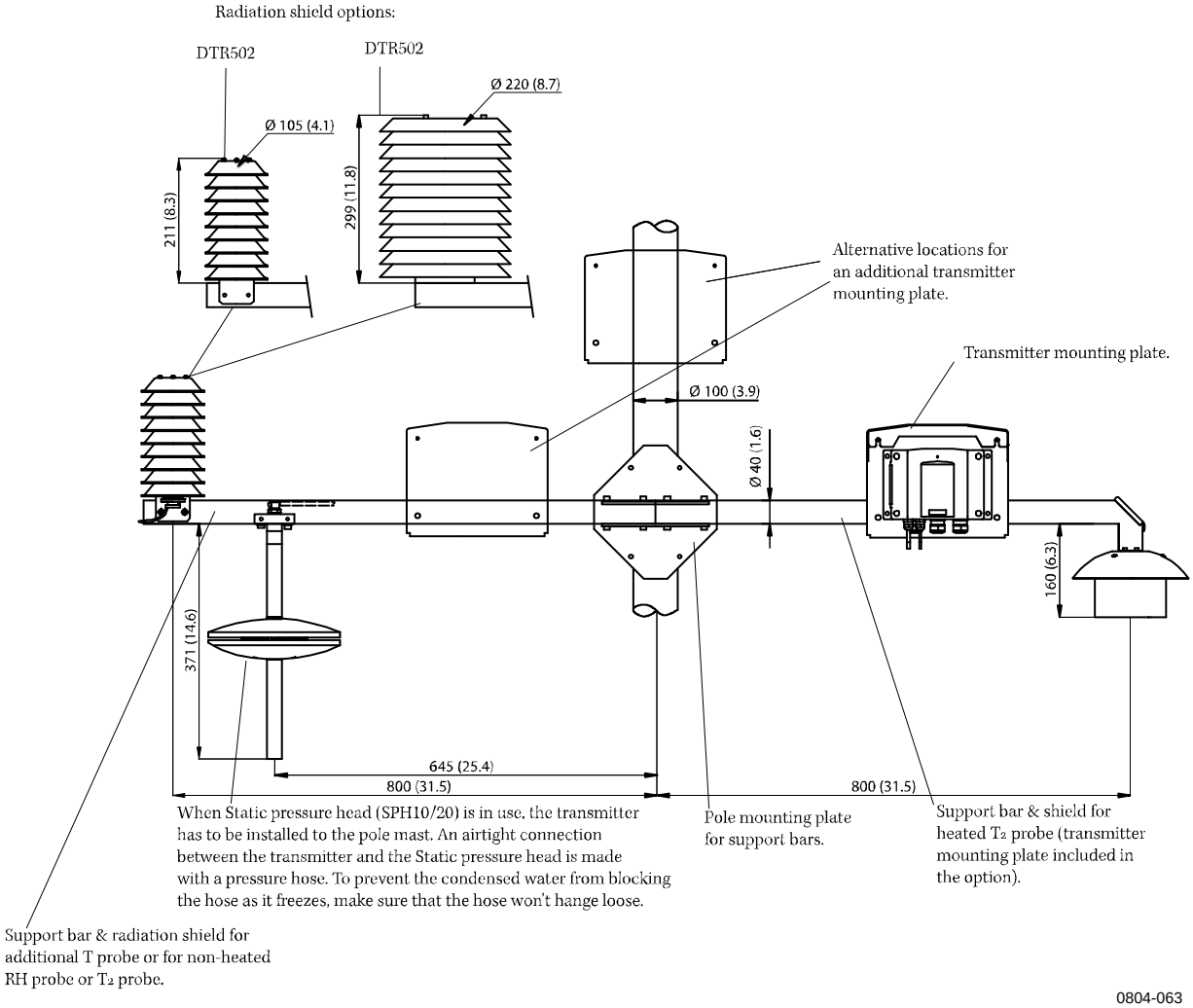
Radiation shield options:
DTR502
DTR502
Ø 220 (8.7)
Ø 105 (4.1)
211 (8.3)
299 (11.8)
Alternative locations for an additional transmitter mounting plate.
Transmitter mounting plate.
Ø 100 (3.9)
Ø 40 (1.6)
160 (6.3)
371 (14.6)
645 (25.4)
800 (31.5)
800 (31.5)
When Static pressure head (SPH10/20) is in use, the transmitter has to be installed to the pole mast. An airtight connection between the transmitter and the Static pressure head is made with a pressure hose. To prevent the condensed water from blocking the hose as it freezes, make sure that the hose won't hange loose.
Pole mounting plate for support bars.
Support bar & shield for heated T₂ probe (transmitter mounting plate included in the option).
Support bar & radiation shield for additional T probe or for non-heated RH probe or T₂ probe.
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Figure 93 Meteorological Installation Kit for Outdoor Installation

APPENDIX B
CALCULATION FORMULAS

This Appendix contains the formulas used for the calculated output quantities.

The HMT330 series transmitters measure relative humidity and temperature. From these values dewpoint, mixing ratio, absolute humidity and enthalpy in normal pressure are calculated using the following equations:

Dewpoint:

$$T_d = \frac{T_n}{\frac{m}{\log\left(\frac{Pw}{A}\right)} - 1} \quad (1)$$

P_w is the water vapor pressure. The parameters A, m, and T_n depend on temperature according to the following table:

t	A	m	Tn
<0 °C *	6.1134	9.7911	273.47
0 ... 50 °C	6.1078	7.5000	237.3
50 ... 100 °C	5.9987	7.3313	229.1
100 ... 150 °C	5.8493	7.2756	225.0
150 ... 180 °C	6.2301	7.3033	230.0

1) Used for frostpoint calculation if the dewpoint is negative

Mixing ratio:

$$x = 621.99 \cdot \frac{P_w}{p - P_w} \quad (2)$$

Absolute humidity:

$$a = 216.68 \cdot \frac{P_w}{T} \quad (3)$$

Enthalpy:

$$h = (T - 273.15) \cdot (1.01 + 0.00189 \cdot x) + 2.5 \cdot x \quad (4)$$

The water vapor saturation pressure P_{ws} is calculated by using two equations (5 and 6):

$$\Theta = T - \sum_{i=o}^{3} C_i T^i \quad (5)$$

where:

T = temperature in K
C_i = coefficients
C_0 = 0.4931358
C_1 = $-0.46094296 * 10^{-2}$
C_2 = $0.13746454 * 10^{-4}$
C_3 = $-0.12743214 * 10^{-7}$

$$\ln P_{ws} = \sum_{i=-1}^{3} b_i \Theta^i + b_4 \ln \Theta \quad (6)$$

where:

b_i = coefficients
b_{-1} = $-0.58002206 * 10^{4}$
b_0 = $0.13914993 * 10^{1}$

where:

b_1 = $-0.48640239 * 10^{-1}$
b_2 = $0.41764768 * 10^{-4}$
b_3 = $-0.14452093 * 10^{-7}$
b_4 = 6.5459673

The water vapor pressure is calculated using:

$$P_w = RH \cdot \frac{P_{ws}}{100} \quad (7)$$

Parts per million by volume is calculated using:

$$ppm_v = 10^6 \cdot \frac{P_w}{(p - P_w)} \quad (8)$$

Symbols:

T_d = dewpoint temperature (°C)
P_w = water vapor pressure (hPa)
P_{ws} = water vapor saturation pressure (hPa)
RH = relative humidity (%)
x = mixing ratio (g/kg)
p = atmospheric pressure (hPa)
A = absolute humidity (g/m3)
T = temperature (K)
h = enthalpy (kJ/kg)

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